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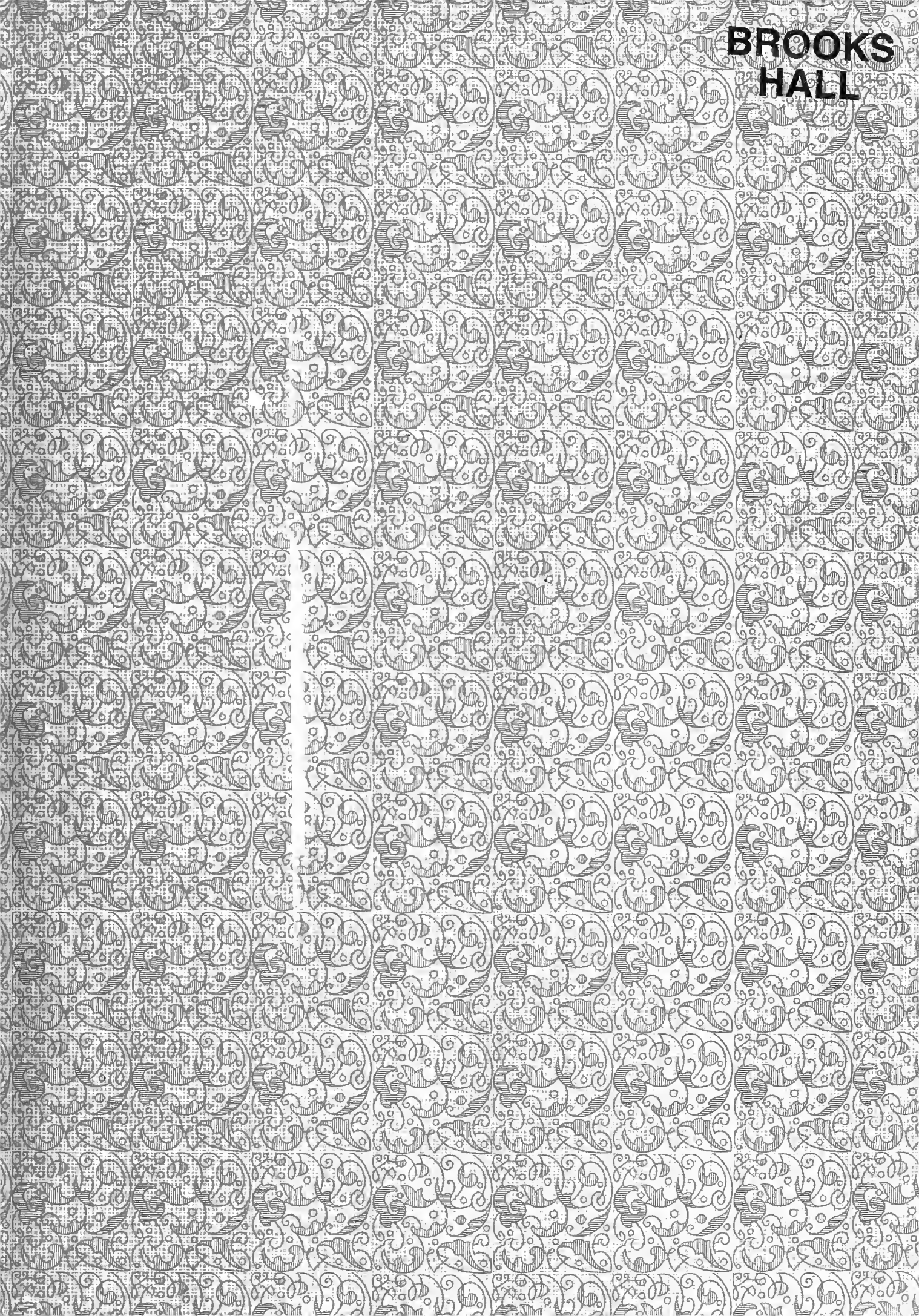
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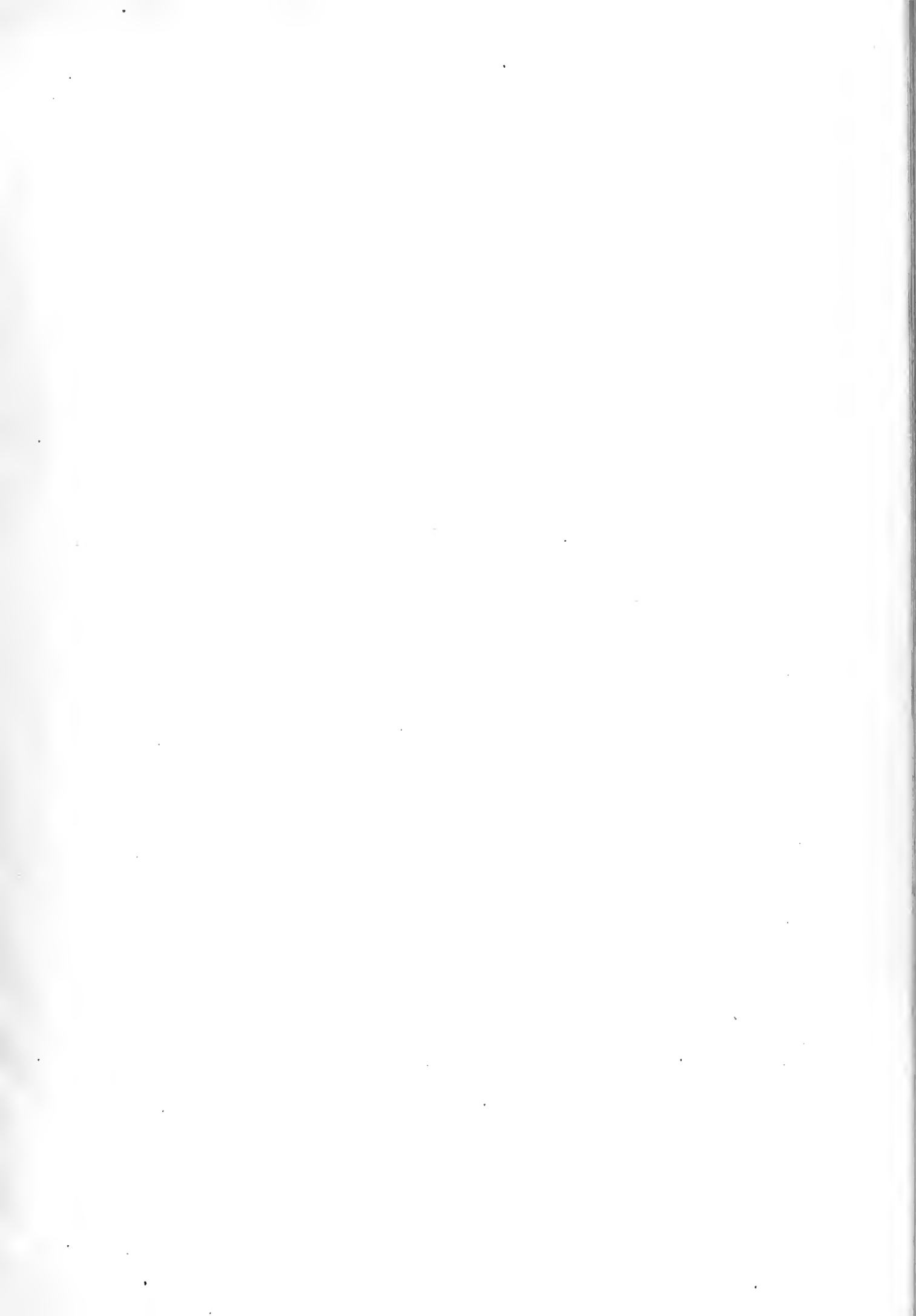
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JOURNAL OF ELECTRICITY

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Devoted to the Conversion, Transmission and Distribution of Energy

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SAN FRANCISCO, JULY 4, 1914

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ANALYSIS OF ARCH DAM STRESSES.

BY GALE S. STROUT.

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HOW COMMISSIONS REGARD UTILITIES.

BY H. D. LOVELAND.

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VOLUME XXXIII

SAN FRANCISCO, JULY 4, 1914

NUMBER 1

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LAYING THE LARGEST SUBMARINE POWER CABLE

BY JOHN A. KOONTZ JR.

(The methods used in laying the new 22,000 volt cable of the Great Western Power Company under San Francisco Bay are described in detail. The illustrations are particularly effective in showing each step in splicing the cable. The author is an engineer with the Great Western Power Company.—The Editor.)



Cable Laying Barge, Showing Cable Grip.

The Great Western Power Company has just placed in operation its second 11,000 volt, submarine power cable, across San Francisco Bay. This cable is the largest high voltage submarine cable in operation in this country, as it is larger by some 18 per cent than the first transbay cable installed by this company, as described in this journal March 16, 1912.

The cable in question is a three conductor, graded insulation, armored cable of an overall diameter of 4 in. It runs from a point near the ferry slip on the Western Pacific Mole in Alameda county, to Harrison street wharf, in San Francisco, a distance of 20,788 feet. It was necessary to make this cable in sixteen lengths, each length being shipped on a separate reel, the weight of which was 15 tons.

The major portion of the cable contains 3-250,000 cm. stranded copper conductors, first insulated with a coat of 6/32 in. 30 per cent para rubber compound, then taped thereover with 2/32 in. of varnished cambric. The insulated conductors are then spirally wrapped, and the spaces filled with jute and insulating compound. Overall is wrapped a belt of 5/32 in. of var-

nished cloth. Next is placed a lead sheath 5/32 in. in thickness, then a coating of jute, next the armor wires, and as a finish the cable is given a final jute coat.

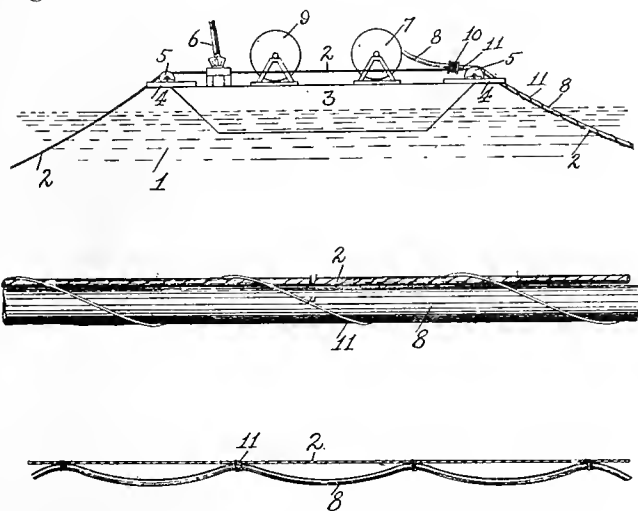
At the shore ends on account of the poor radiating conditions to which they are subjected, the conductors are of 300,000 cm. cross section, the same grade and thickness of insulation being used as in the 250,000 cm. cable.

Numerous submarine and river cables are operated by this company, varying in voltage from 2200 to 22,000 volts, and in no case to date have we a record of the failure of the cable proper, except as caused by some outside mechanical injury, such as being cut by propeller blades, or pulled apart with an anchor. All electrical failures have been at the joints.

The most difficult problem in installing a submarine power cable is to make the joints in such a manner that no mechanical strain be thrown on the conductors or lead sheath while the cable is being installed or repaired. The armor wires are spirally wrapped around the cable, and it is practically im-

possible at a joint to get these wires so served and wrapped that the armor will take all the strain. Any severe strain on the cable tends to lengthen the armor wires due to this spiral wrapping, as the material of the cable has a more or less plastic nature. The armor wires when stressed will grip the cable and embed themselves slightly into the jute and lead, thus allowing them to increase in length without a corresponding increase in length of the lead sheath or copper conductors.

Mr. A. J. Pahl early realized the difficulties in handling submarine cables, and the strains to which they are subjected in laying, so to overcome these difficulties he devised and patented the use of a messenger cable. The function of this messenger cable



Patent Drawing of Cable-Laying Method.

is quite like that of an aerial messenger, its object being to support the power cable, taking all the strains and provide a means of directing and anchoring the barge while reeling out or splicing the power cable.

In the present installation the $1\frac{1}{8}$ in. steel messenger cable was first securely fastened at the San Francisco end, then reeled out across the bay to the Western Pacific Mole. Brakes were used on the reel to prevent excess slack in the messenger cable only at points where a change in course was made. Upon reaching the Western Pacific Mole the other end of the messenger cable was securely fastened.

A 150 ton barge was equipped with sheaves, cable grip, and reel supports, and the barge loaded with four reels of cable. The steel messenger was then picked up and placed in the sheaves, and the power cable started overboard. The power cable is lashed to this messenger, using a continuous wrap of No. 6 galvanized wire, and at 20 ft. intervals the two cables are firmly served together.

The barge was towed by a 40 h.p. launch, which was directed over the original route, the messenger cable in itself tending to keep the barge in the proper course. By the use of the cable grip the barge is started and stopped at will, for the launch is kept towing continuously while the power cable is being reeled out. When the end of a reel is reached the cable grip is set and the barge stopped.

The armor on the two ends that are to be spliced together is laid back and the lead sheath cut away, and the conductors bared for the splice, as shown in Fig. 1. A portion of the cable proper of each end

to be spliced, is cut away leaving the armor wires. This is to give sufficient length of armor wire to serve properly over the splice. It is well to note in this figure the spreaders used to keep this armor wire in position.

In Fig. 2 the copper sleeves are in place over the joints in the conductors; also the lead sleeve has been slipped over the cable and is ready to be drawn in place after the conductors are insulated.

The joint has been completed, in Fig. 3, the lead sleeve having been drawn into place, wiped, filled with compound and sealed. The joint is now ready for its jute covering, Fig. 4.

The armor wires from one side of the splice are now wrapped back over the joint, at places passing over interlocking rings, as shown in Fig. 5. These interlocking rings are for the purpose of binding the armor of the two pieces of cable securely together.

After the first layer of armor wire is placed and served, as shown in Fig. 6, the armor from the other side of the splice is then wrapped over the joint and again securely served. The final appearance of the joint is as shown in Fig. 7.

This present cable was laid under contract by Mr. A. J. Pahl, who guarantees the cable for sixty days after acceptance and commencement of operation. Before acceptance, the cable was given a test of 22,000 volts, between conductors and sheath, and 30,000 between conductors, each test being applied for a period of five minutes. The point of reliability of high voltage submarine cables for duty the same as that in San Francisco Bay has been proven without a doubt by this company, for it has 2-22,000 volt cables operating across the Carquinez Straits. One of these cables has been in operation two years, the other eighteen months, there being only one case of trouble in either cable up to this time, and that was due to a sugar steamer catching the cable while dragging anchor, and pulling both power and messenger cables in two.

RESIDENCE SERVICE CAMPAIGN.

The Commercial Section of the National Electric Light Association now has ready its Residence Service Advertising Campaign for the use of member companies in obtaining residence business, housewiring, etc., and in furthering the use of current consuming appliances.

This service comprises 13 separate pieces of advertising literature, including snappy, suggestive booklets, mailing folders, and fac-simile letters with return cards, designed to cover a maximum period of twelve months, or to be mailed twice a month if necessary, space being provided on each piece of printed matter for the imprint of the local company making use of this service. The scheme is so flexible that large companies having their own advertising departments will find that this service may be dove-tailed into their existing or prospective new business campaign with the greatest ease and with the most gratifying results. Other companies who may lack the facilities of an advertising department, or who can hardly afford the expense of employing advertising experts to build up special campaigns, will find this Residence Service Campaign a wonderfully effective and inexpensive solution of one of their most difficult problems.

METHODS OF SPLICING POWER CABLES.

Fig. 1. Conductors Bared for the Splice, (21 in. between Ends of Lead Sheath, 6 in. Sleeve on Conductors). Note Rings for Laying Back Armor wires, 42 No. 4 Galvanized Steel.

Fig. 2. Sleeves Soldered on Conductors, (Sleeves $\frac{3}{4}$ x 6 in.; Ends of Lead Sheath 24 in. Apart, Lead Sheath, $4\frac{1}{2}$ x 36 in.)

Fig. 3. Filling Sleeve With Ozite Compound After Joint Is Wiped.

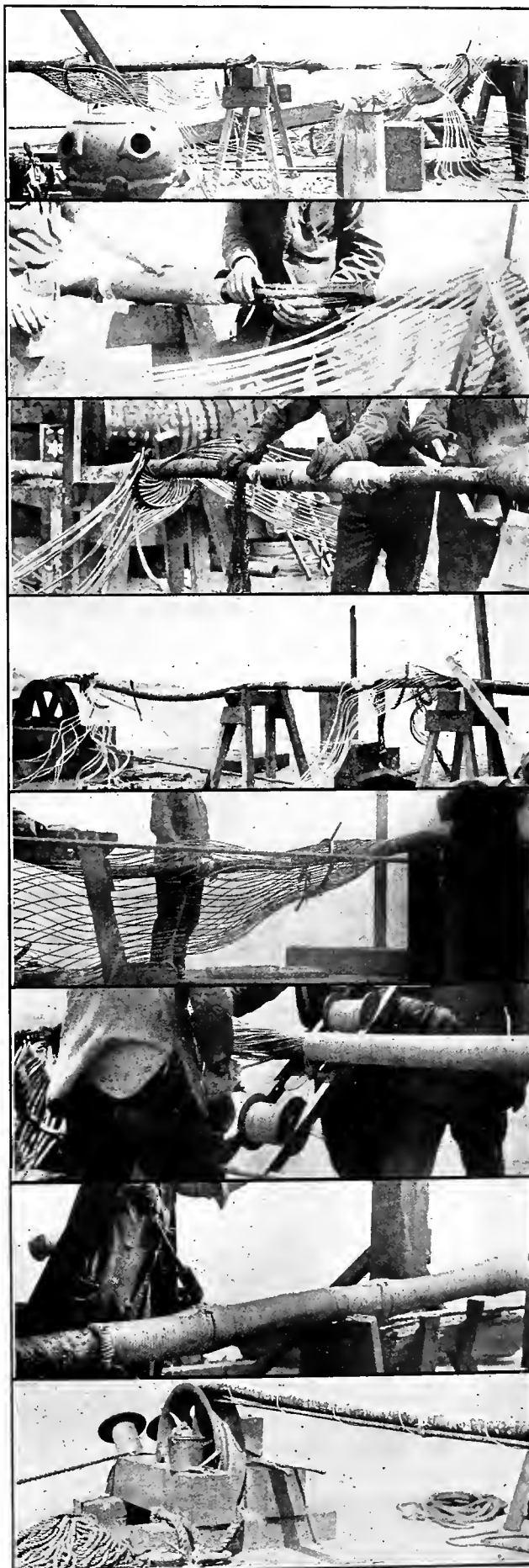
Fig. 4. Joint Sealed and Ready for Jute Wrapping.

Fig. 5. Laying Down Armor Wires Preparatory to Serving. Interlocking Rings are 4 in. Long With Double Taper, $\frac{5}{8}$ in. Thick, Center Turned and Bored from Solid Shafting.

Fig. 6. Serving First Layer of Armor With No. 9 Galvanized Steel Wire.

Fig. 7. Completed Serving Over Outside Armor, Showing Ends of Armor Wires Turned Back to Prevent Cutting Into Lead Sheath. Bulges are Caused by Interlocking Rings.

No. 8. Method of Serving Power Cable to Messenger Cable With Continuous Special Wrap of No. 9 Galv. Wire and 20 Turns of Wire Every 20 ft. Also Showing Special 2.4 ft. Sheave With Deep Groove for Messenger Cable.



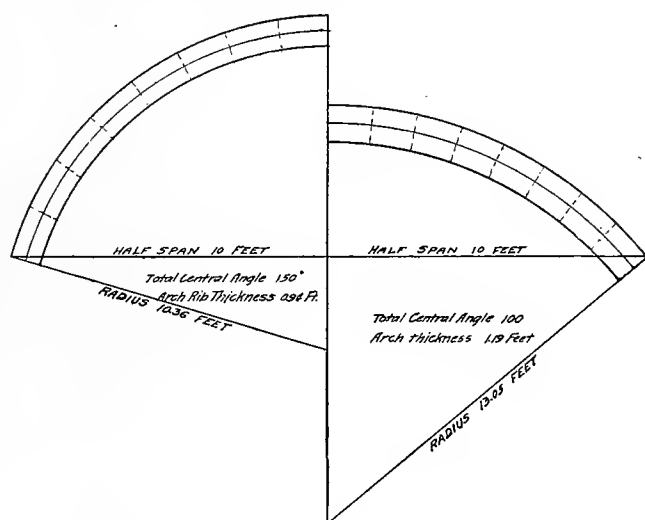
ANALYSIS OF ARCH DAM STRESSES.

BY GALE S. STROUT.

(Important conclusions are reached by considering each element of the multiple arch dam as an elastic arch whose secondary stresses are analyzed under water load and temporary change by the author. Mr. Strout, whose office is in the Sheldon Building, San Francisco, gives high praise and credit to the Eastwood multiple arch dam.—The Editor.)

It is gratifying to note the increased interest that engineers are taking in the structural type of dam. This is clearly evinced by the ever increasing number of articles appearing on this subject.

The writer claims to be a conservationist, and has always enjoyed reading articles that appeared to lead to this end. He has for several years read all articles upon the arch dam, that have ever come to his attention, but never entered into the study of it seriously until the fall of 1912. At that time he was with the State Railroad Commission of California in the hydraulic department of engineering, and the plans for the Big Meadows Dam, then being built by John S. Eastwood for the Great Western Power Company, were brought there for a thorough analysis. It fell to the lot of the writer to make the stress analysis. This proved exceed-



Graphical Comparison of Arch Ribs Considered.

ingly interesting, and although some startling revelations were brought to the surface, the result of the study made him not only a convert but an advocate of this type of dam, when physical and financial conditions will warrant its use.

Of the articles appearing upon the arch type of dam, the writer has never seen one that has entered into the subject and made the analysis as is customary with the design of an arch bridge. That is, treat it as an elastic arch, and determine the secondary stresses set up by the deformation of arch rib due to shortening under water load, and shortening and lengthening under temperature change.

It is the writer's intention in this article to deal only with this one element of design.

An arch ring subtending a central angle of 133 deg. 34 min. is recognized to be the economical arch for spanning a given uniform opening. This is true for a minimum of material in the arch ring, considering the standard formula:

$$T = p r \dots\dots\dots (1)$$

when T is the total tangential thrust due to water load, p the unit pressure and r the radius of upstream circle.

This gives only the initial stress. To it must be added the secondary stresses. These are:

1st. The stresses caused by the shortening of arch rib under water load.

2d. The stresses caused by shortening or lengthening of arch rib due to fall or rise of temperature.

These later stresses are frequently mentioned by writers as existing, but are considered of no consequence and dismissed as having no real weight. A mathematical analysis of them proves quite the contrary.

The secondary stresses set up in an arch rib for any given depth below the water surface are independent of the length of span, but dependent upon the length of arc. To illustrate the variation of these stresses I have taken a numerical example as follows:

Span of arch ring 20 ft.
Water depth 70 ft.
Unit of pressure (initial) 24 tons per sq. ft.
Central Angles:

1st 150 degrees
2nd 100 degrees

The selection of the above central angles is made so as to be somewhere in the vicinity of the supposed economic arc, on both sides of it, and with enough difference in angle to show clearly how materially the length of arc influences the final total stresses.

The illustration gives a graphical comparison of the length of the two arches selected.

I will not burden the reader with the computations necessary to reach the final figures, but merely tabulate the comparative results.

Table Showing Comparative Stresses in Arch Rings of Different Lengths.

Cause of Stress.	Stress in Tons per square foot.	
	Central Angle.	
	100°	150°
Initial (or direct) due to water load.....	24.00	24.00
Bending at spring line due to rib shortening under load	20.30	8.30
Bending at spring line due to rib shortening under temperature drop of 25° below setting	18.25	7.50
Maximum fibre stress	62.55	39.80

The units used in the determination of the above figures are: Concrete modulus of elasticity 2,000,000 lb. per sq. in., and concrete coefficient of expansion 0.000006. In the above table the final stresses are not absolute, the stresses due to the direct thrust caused by rib shortening being omitted. These are slight and are therefore not computed.

The maximum fibre stress in an arch rib occurs at the buttress. This decreases along the arch rib until the point of uniform direct load is reached. Here a reversal of eccentricity of loading takes place and increases to the crown. The condition for maximum stress is with the reservoir full and the temperature at a minimum. In the above a temperature drop of 25 degrees is chosen arbitrarily, and is perhaps somewhat higher than will be found under average conditions. This will vary with the locality and must be treated specially, if a monolithic type of structure is built.

In these figures no recognition is made of the steel reinforcement, but the arch is treated as though built of concrete. For economy this should be the case, and what steel is placed in the structure should be treated as a reserve and insurance against local temperature cracks and abnormal conditions.

In further justification of a thin arch for ultimate economy and strength, it might be well to consider the nature of the load that the arch rib has to carry. Some writers choose to consider the arch rib as a column. If such were the case there would be a definite limit to the thickness. But there is theoretically no logical reason for considering it as a column. A column receives its load at one end. This load is transmitted through the column to the other end with no lateral support to assist the material of which the column is composed. It is therefore of vital importance that the ratio of thickness of column to its length, be kept at a minimum. With a circular water-loaded arch rib, the loading is a condition of absolute equilibrium. In this case the load originates along the arch rib uniformly, and is reacted upon at the buttresses. If the buttresses are unyielding, and the arch rib is a true circle, horizontally placed, then nothing but destruction by crushing could cause a failure.

At the time of the San Francisco earthquake, the writer made numerous observations that at first seemed contrary to what would be expected. Buildings pivoted on jacks preparatory to moving or raising were unharmed. The earth had merely vibrated beneath them, upon the same principal as the sismograph. Many well built frame houses were torn and split, while many cheaply built houses were unharmed. In the former case the earth movement had been transmitted to the building through its rigidity. In the latter case the building had not received the full movement of the earth and that portion of the movement received had been dissipated through the elasticity of the structure without damage. This same condition, the writer believes, would hold true of a water loaded arch. The more capable it is of resisting shock, the more enduring it would be as a structure under abnormal conditions.

In beginning this article the writer promised to confine himself to the arch. It is a temptation though to reach out and speak of the many advantages offered by the arch type of dam, especially as to its flexibility in meeting varying conditions. But these points have been well covered by others so he shall abide by his promise.

The writer believes that the structural type of dam has a big future before it, and that the engineering profession is awakening to its possibilities.

The density of oil is usually expressed in degrees Baume, or the reading of a Baume hydrometer floating in the oil. Water is taken as a standard with a graduation of 10. The instrument sinks further in oil than in water and consequently shows a higher reading—the lighter the oil the higher the reading in degrees B. Density is also expressed in terms of specific gravity, which decreases as the Baume scale increases. Thus a specific gravity of 1 corresponds to 10 degrees B., of .9 to approximately 25 degrees B., and of .8 to about 55 degrees B.

OREGON HYDROELECTRIC COMMISSION REPORT.

BY W. D. B. DODSON.

(This is the first annual report of the commission's work, Mr. Dodson being secretary. It was presented at the Commonwealth Conference in Eugene on May 28, 1914. It constitutes a masterly discussion of the power and industrial situation in the state.—The Editor.)

Oregon has two superb assets, productive soil and water power, both yet in a somewhat neglected state. For the want of an adequate market, development of both are retarded. It may be that speculative profits of an abnormal character enter the cause for the backward state of each. In whatever measure this may be the case, they must be eliminated. Proper investment to the end of maximum production will be protected. But so far as the speculator stands between production and the consumer, he must be urged to stand aside. If our rich soil, now idle in millions of acres, is held at too high a price for the thrifty, frugal husbandman, a better opportunity must be opened. Those hardy workers, seeking the haven of an independent farm home, who are turning to the cheap lands of other parts of the world, must be drawn here and given a full, fair, honest opportunity. Personally, I believe that no effort is too great for the state to make to attain this end. It is in the realm of possibility. It must be done.

Water power, industry's supreme desire, also flows to waste on every hand throughout the state. How we can utilize it in practical manner is a problem of such urgent, imperative, far-reaching moment, that the state might well give it thought second to full cultivation of the soil. If this wasting energy is 3,000,000 horsepower, on the minimum flow of the streams, as has been officially estimated, or if it is 6,000,000 horsepower, as some private engineers assert, it would turn the wheels for several million busy, prosperous workingmen. How to get these workingmen and the industries upon which they are dependent, is the monumental work which the commission has essayed to determine, although our beginning has been humble and barely perceptible on the part of the masses of the people.

Oregon has many industrial disadvantages in competition with the old institutions of the East. We have no commercial deposits of iron, measured by present reduction systems, so far as exploration of the geologist and mineralogist have gone. We have no valuable coal measures. Oil has not been tapped in paying quantities. Our wage scale is relatively high. Population is sparse, transportation to consumers in large numbers is high, and distance may not be annihilated. We have found that even the limerock needed for certain electrical industries, the rock that is usually regarded plentiful as common stone, did not exist in that purity near certain centers which was demanded. All these and many others are limitations placed by Nature and the condition of things which it is idle to combat. But we have water power, in greater measure than any other state with the possible exception of Washington. We have this asset in such abundance that it actually palls, like the Douglas Fir forest when the first settler came. Abundant as it is, it yields us little more than nothing.

Development of this asset can be achieved. It is one of those reasonable possibilities worth trying. Extensive success means so much to the state that Oregon, in any fair business study, could afford to make an enormous investment in trying to harness the wasting energy to the wheels of industry. While the official estimate of the commercial energy at the minimum flow of the streams of the Columbia Basin is put at 12,775,000 horsepower, there are actually being utilized of this a scant 300,000 horsepower. You will appreciate from this disparity that a bare suggestion of use exists now. Where a few thousand people are employed as a result of the harnessing, millions could be accommodated if only we could devise the ways and means to turn the tide of National industry dependent upon electrical energy or cheap power to this State and its tributary region.

I review these generalities to place before you the stupendous nature of our problem. With the impression as to the enormity of the work, must also go the conclusion as to benefits when success is attained. One-half a horsepower effective through the year, is sufficient for the manufacture of a ton of artificial nitrates by the fixation process. One-third of a horsepower is equal to the task of producing a ton of pig iron from raw iron ore. You know the energy required in various factories, where a thousand horsepower means a big payroll.

With a profound conviction of the benefits to be derived, and many vivid suggestions of the difficulties to be overcome, the Oregon Hydroelectric Commission set about its work. Immediately authority was granted at the last Commonwealth Conference. Chairman H. B. Miller named as his co-workers the following persons:

Judge Thomas C. Burke, collector of customs at Portland, vice-chairman; Prof. F. G. Young, father of the Commonwealth Conference movement, and jointly with the state engineer father of the hydroelectric commission; Prof. Thomas A. H. Teeter, instructor in hydraulics at the Oregon Agricultural College; Dr. J. F. Watt, Hood River; W. H. Graves, president of the Oregon Society of Engineers; J. V. Tallman, president of the Pendleton Commercial Association; H. L. Vorse, electrical engineer, Portland; Hon. John McCourt, ex-United States District Attorney for Oregon; William Hanley, Burns; C. A. Park, Salem; T. H. Burchard, president of the Oregon State Federation of Labor; B. G. Leedy, chairman of the State Grange committee studying water power resources; Mrs. Clara Waldo, a leading agricultural and industrial worker of the State Grange, and W. D. B. Dodson, trade commissioner for the Portland Chamber of Commerce.

This body resolved itself into almost as many sub-committees as it had members at the first meeting. Each committee was charged with the duty of investigating some phase of water power resources, electrical generation, and the application of electrical energy to agricultural and industrial production. This work is proceeding slowly, as the individual committeemen have their own business affairs as a first call upon their time, but are giving generously to the research work of the commission.

As the base of procedure, the commission has inaugurated the effort to get from all parts of the

world accurate, complete data on electrical developments. As the first step in the quest, the secretary of state for the federal government has been requested to have each consul in the national service answer an exhaustive series of questions as to actual achievements in his district. This query covers all details on cost of construction, operation, transmission, etc., divided into units in such manner that satisfactory comparison may be made in this country where varying wage scales, material costs and overhead charges are found.

Our first response to this line of inquiries brought the definite statement that in Norway the construction cost of water power plants varies from \$26.80 to \$53.60 per horsepower for large plants, and \$26.80 to \$134 per horsepower for smaller ones, while the charge for the energy ranges from \$8.04 up to \$13.40 per horsepower per year, 24 hours a day service. In this work the commission intends to go deeper, test the accuracy of statements, and when absolutely authentic figures are secured, give the same general publicity. We are inquiring particularly as to the use of electricity in mineral reduction work, and have made our questions very complete in respect to the nitrate and iron and steel industries.

Following up this line of inquiry in a more complete manner, it is the desire of the commission later to have special reports made on great works that have proven of exceptional value in their influence upon industries. To do this, competent engineers will have to be sent on long journeys. For such work, we will have to raise funds, and plan at a later date to ask for voluntary subscriptions from those interested or those grasping the significance of the state's water power resources. We recognize that it is accurate data that will be of use. Only when the people are correctly informed will they be able to act intelligently on their own problems.

One of the first duties the commission undertook was to exercise its maximum influence in trying to have federal laws and regulations made most helpful, and fixed in the principle of not trying to make water power development on federal reserves of the West a source of national revenue. A sub-committee was named by the commission, of which Prof. Young was chairman, to formulate a resolution conveying this thought, and it has been transmitted to the Oregon delegation. Congressman N. J. Sinnot hastened to reply that he had urged before the House committee considering a federal power bill, an amendment embodying identically the same thought as the commission presented, and while defeated before the committee, would again present the amendment before the House when the bill comes up. When we consider that the Forestry Department estimates the commercial water power on federal holdings of this character at 12,000,000 horsepower, practically all in the West, we quickly appreciate the moment of having the most liberal policies in vogue. What might be developed in the navigable streams held under the jurisdiction of the War Department, and what might be had from the reserve holdings controlled by the Interior Department, would bring the total under federal control up to an enormous figure. We believe that the entire West must be aroused to fight against the principle of deriving revenue from such development

work. Such income as will defray the expense of administering the department could be tolerated, if not unduly swollen, but in whatever measure the federal power undertakes to secure a net profit for general use, we will oppose with all possible energy.

Helping in the cause of co-ordinate power and navigation improvement, getting districts organized along navigable rivers for joint power and navigation assessments of the local property, aiding to enact the constitutional amendment permitting the state to sell bonds for arid land reclamation, logged off land clearing, or power development work; studying the whole range of the electricity market in the Northwest; starting inquiries as to the cost of energy under private and municipal or state control or in state ownership; interesting the engineering societies engaged in electro-metallurgical and electro-chemical industries to hold conventions in the Northwest; inviting private capital to study local resources, and to engage in industries that will use electrical energy, and a multitude of other lines of endeavor have been taken up by the commission. All of these we hope to press with such vigor as to get tangible results in due time.

Some of the members of our commission have enjoyed opportunity during the past year to get intimate knowledge of the requirements of the nitrate manufacture. An engineer from one of the great operating companies of the East toured the Pacific Coast for a location of a nitrate plant. He asked for figures on power costs, the availability and cost of the raw materials, and market conditions. This study revealed that the Portland district is deficient in suitable lime, and that both coke and lime are important studies for Oregon in inviting the nitrate industry. As a result of this investigation we have concluded that, concurrently with the furnishing of cheap power, we must make commercially available the mineral raw materials. Our commission will use this information to best advantage, and seek to enlist the other agencies of the state in procuring these elements.

Most energetic work has been done in trying to secure the fundamental requirements for utilizing electric energy in reduction of iron ore and in the manufacture of steel. Outside sources of supply of iron ore have been taken as the basis. At present China seems to be the most likely, and may continue so unless more stable political conditions in Mexico make Lower California deposits inviting to capital, or unless improved transportation to the west coast of South America brings deposits there nearer. China's ores have been laid down on this coast at slightly above \$4 a ton, and current information indicates that such figures are permanent possibilities. Prof. Stafford of the university, gave to the commission recently a succinct outline of the progress being made in electrical reduction of iron ores, which further proved that the industry will soon be of vital interest to the Pacific Northwest.

The commission has found a strong sentiment of support among the business element of the state, which will take substantial form no doubt as soon as the work is better organized. We have been given strong assurances by the Portland commercial and industrial bodies, the membership of which appreciates the value of more extensive power development. The state engineer, Hon. John H. Lewis, who has been one of the

most powerful workers for increased use of Oregon's idle water resources, has given a helping hand at every opportunity, and will become the commission's official ally in the coming years. Mr. F. A. Henshaw, district engineer for the Geological Survey, in charge of the water resource department, has been as ready as any one could be to help and guide in the most useful directions. The commission has tendered its services to the state commission making a survey of the Five Miles Rapids project at Celilo, in seeking out a power market for such energy as may be found commercially available there, and when the estimates on the cost of this work have been reached, it will be the purpose to make a most vigorous campaign all over the country to determine if the energy indicated may be contracted to some great manufacturing institutions. The commission has gone further, and tried to interest manufacturers in the surplus of electrical energy now available in the state.

APPLIANCE SALE BY UTAH LIGHT AND RAILWAY COMPANY.

The Utah Light & Railway Company announce a change of policy in the operation of its commercial office and electric shop at Salt Lake City. The company's general offices are one block from the main business street at a rather inconvenient location for its patrons. Its office quarters at this location were so crowded that it was impossible to find space to introduce a display of current consuming appliances, a thing which the company had felt the necessity of for some time. They decided to obviate these difficulties by renting an office on Main street and fitting it up as a commercial office and electric shop, which was opened to the public in December of last year.

The company did not intend at the outset to sell electric appliances at this new shop, but simply to have them there on demonstration and to refer prospective purchasers to the various electric supply dealers of the town who handle these appliances. The careful observation of this plan of conducting a demonstration room only has convinced the officers that the results secured do not justify the expense of operating a demonstration on the somewhat elaborate scale that the company has installed. It was apparent that the stock in a short time would have an obsolete and shopworn appearance, which does not obtain in a store where the stock is being turned over two or three times a year.

Viewed from every standpoint the company felt that in order to achieve the greatest results not only to itself, but to the entire electrical industry in the territory it served that they should inaugurate a vigorous sales policy conducted along progressive business lines. They took the matter up with the various electric supply interests and explained that their plans were to continue to co-operate with the supply dealers as they had done in the past by maintaining such prices as would give a fair profit to themselves and to the dealers and by purchasing their appliances through local jobbers when this could be done on equally advantageous terms. The dealers have viewed the matter broadly and have proffered their continued active co-operation and support as they have in the past.

A LABORATORY SOURCE OF SUSTAINED HIGH VOLTAGE AT HIGH FREQUENCY.

BY J. C. CLARK.

(This is the first of a series of articles concerning the marvelous experiments with high voltage at high frequency which are being conducted at Stanford University under the direction of Prof. Harris J. Ryan, assisted by Prof. Clark. This paper describes the apparatus used, the next will describe the experiments, and subsequent articles written by Prof. Ryan will take up the high voltage potentiometer and its application in determining the voltage duty of the units in suspension type insulators. The articles are not only of intense theoretical interest but of great practical value in determining why insulators fail.—The Editor.)

For some years it has been known that many insulator failures are chargeable to the damaging presence of high frequency currents on electric transmission and distribution lines. Accordingly, the need has been felt in many quarters for a more extended knowledge of the properties of high frequency electricity. It was in response to this need that certain apparatus to produce sustained high frequency high voltage for experimental study has been developed in the electrical engineering laboratory at Stanford University by Professor Harris J. Ryan and the writer, and it is the purpose of this article to describe this apparatus.

As to the means of securing sustained high frequency oscillations, the general method which seemed most promising at the outset was that which depends upon the well known property of a continuous current arc in exciting oscillations in a low resistance circuit containing inductance and capacity shunted across the arc. Various investigators have developed this method differently as to details, but the arrangement of Valdemar Poulsen has proven to be the most satisfactory for steadily circulating large amounts of reactive power in the oscillatory circuit. The Poulsen Arc-Generator (for a detailed description of which the reader is referred to "Wireless Telegraphy" by G. W. Pierce, Chap. XXIII.), consists essentially of a continuous current arc between positive copper and negative carbon electrodes. This arc is formed in an atmosphere of reducing gas, or vapor, and a strong magnetic field excited by the arc current itself is so mounted as to blow out the arc. The generator is capable of operating under these adverse circumstances only when a rather high continuous voltage is applied to the arc and when it is shunted by a freely oscillating circuit of inductance and capacity.

In the fall of 1912, the department came into the possession of a 5 kw. Poulsen Arc-Generator, Fig. 1, together with a copper helix and a quantity of supplies, through the generosity of C. F. Elwell, then chief electrical engineer for the Federal Telegraph Company. Pending the provision of more suitable quarters in a new high voltage laboratory, the generator was temporarily installed in the main electrical engineering laboratory at Stanford, and an oscillatory circuit provided for the circulation of high frequency current. The latter circuit consisted at first of the small helix above mentioned, and shown in Fig. 2, connected to an air condenser made of several galvanized iron cylinders each 5 in. in diameter and 6 ft. long with closed hemispherical ends.

The need for measuring the high frequency voltage produced in the small helix presented itself at once to the observers, as did also the lack of suitably developed apparatus at hand for such measurement. In considering the field of possibilities as to apparatus for high frequency voltage measurement, only one expedient seemed at all promising; viz: the measure-

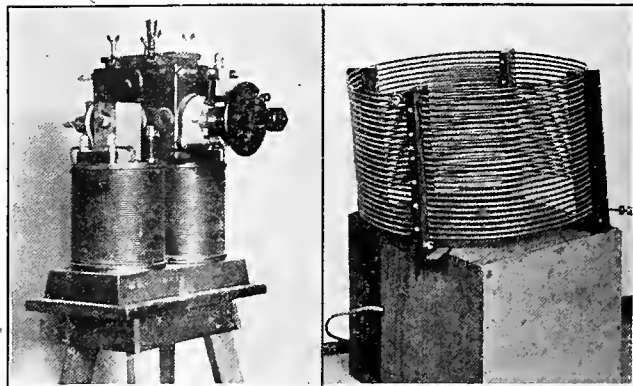


Fig. 1. 5 kw. Poulsen Arc Generator.

Fig. 2. Small Helix.

ment of sine wave current running into a condenser of known capacity at measured frequency. For the measurement of frequency, a standardized "wave-meter" was used. This consists of a standard inductance, an adjustable standard condenser, and a hot-wire ammeter, all connected in series. This condenser was adjusted to resonance with the inductance, as indicated by a maximum reading on the hot wire meter. From a knowledge of the constants of the wave meter, the frequency is readily calculated. Some early rough measurements of voltage were made, using a condenser of calculated capacity, and passing current at measured frequency into it through the filament of an incandescent lamp. By comparing the brilliancy of the lamp filament with that of a similar lamp lighted by measured direct current, it was possible to secure a fairly accurate knowledge of the magnitude of the high frequency condenser current, and thus to calculate the voltage producing the current.

Steps were at once taken to provide more refined voltage measuring facilities, and some of those now available for use are, in essential parts, exactly the same as the ones used in the early rough measurements, although differing much in general appearance. However, the entire development of voltage measuring apparatus was directed toward the development and calibration of a sphere gap, constructed on the lines of the sphere gap proposed as a standard for low frequency voltage measurements by Messrs. Farnsworth and Fortescue. (See Proc. A. I. E. E. Feb., 1913, p. 299.) All other methods used for voltage measurement were but intermediate means toward this end. For a description of these means and also an account of the calibration of a 7 in. sphere gap, see paper recently submitted to the A. I. E. E. by Professor Harris J. Ryan and the writer. (This paper gives in detail also the construction and standardization of the wave meter above mentioned.) It should be noted that it is impracticable to maintain for an appreciable time the sharpness of needle points with any considerable high frequency voltage upon them owing to the melting and burning action of the coronas at the points.

The desire to increase the high frequency voltage resulted in the construction of six new helices. Each helix was wound of 25 turns $\frac{1}{4}$ in. copper tube upon hard rubber supporting posts, and the six helices were graded uniformly in diameter so as to nest inside each other. For the sake of simplicity in the connections between consecutive helices, they were at first wound in the same manner as one ordinarily winds a magnet coil: i.e., up on one layer, and down on the next, so that, if the current enters at the bottom of the first helix, leaving it at the top, it enters at the top of the second helix, leaving it at the bottom, and

local corona has been eliminated at any voltage the helices have yet been called upon to generate.

Another nest of helices has since been built. This second nest is wound of flat magnet wire and is insulated with paraffined oak sticks. It is made as nearly an exact duplicate of the first nest in dimensions as possible, but the difference in the conductor section made the length of winding in the second set slightly greater than that of the first. The length of this second set of helices is 14 in. The diameters of the 6 helices of the set range uniformly from 41 in. down to $14\frac{1}{2}$ in. The two 6-helix nests are shown in Fig. 3.

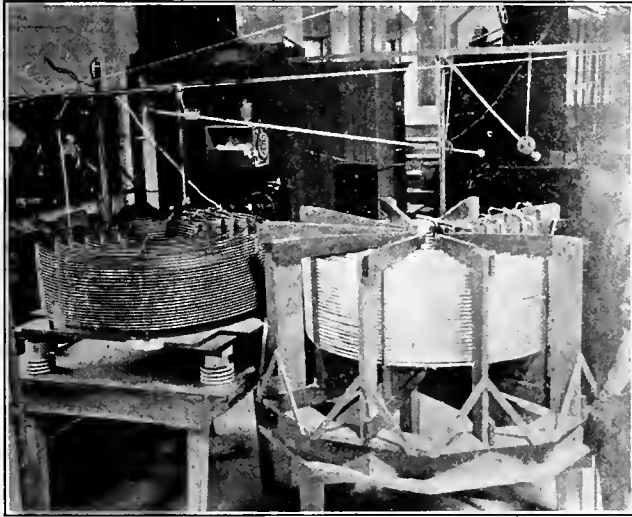


Fig. 3. Two 6-Helix Nests.

so forth. When, however, the nest of six helices was connected into the resonant circuit, an attempt made to excite oscillations was unsuccessful.

The reason for this failure of the six helix nest to excite will become apparent when one considers the broken manner in which the internal condenser of the coil was compelled to function. It will be seen that the effect of the method of connection used was to break up the nest of six helices into five subordinate oscillating circuits each having a natural frequency different from that of any of its neighbors. It is but natural that this chain of circuits should fail to function as a coherent unit.

To overcome this defective action of the coil, the turns of all helices were laid on in the same manner, and connected in such a way that the current leaving the top of helix Number 1 enters the bottom of helix Number 2; that leaving the top of Number 2 enters the bottom of Number 3, and so on. In other words, connections were made from the top of each helix to the bottom of its inner neighbor in regular order throughout. With the coil so arranged and connected, no further trouble was experienced from this source in securing oscillations at high frequency. A study of the distribution of potential through the nest of helices will now show that the source of trouble is removed by this new manner of connection. The nest no longer functions as a series of somewhat unrelated minor circuits but now possesses unity of action. It should be noted that this method of connection also prevents undue concentration of the electric field at any place by a uniform and easy grading of the potential through the nest of helices. Thus

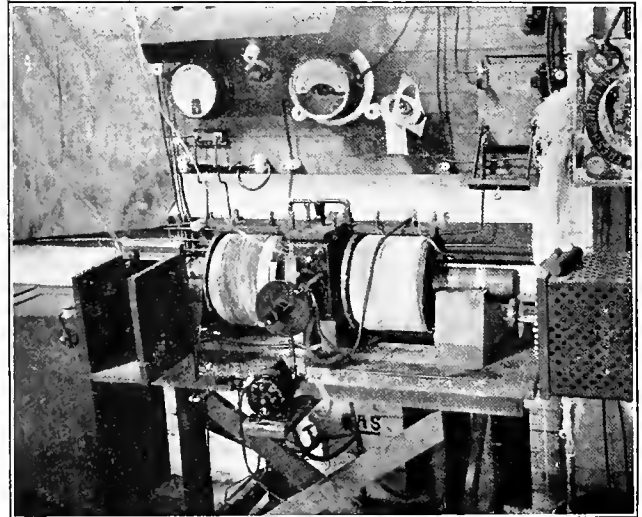


Fig. 4. 12 kw. Poulsen Federal Generator.

The limit of the capacity of the 5 kw. Poulsen generator was practically reached at the time when

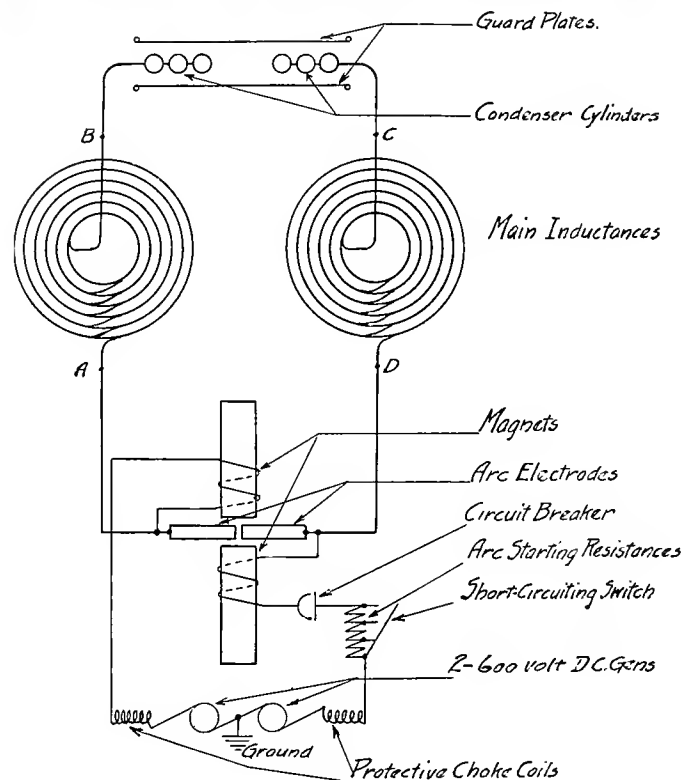


Fig. 5. Connection Diagram.

the first nest of helices was put into use, and the 5 kw. generator was exchanged for a 12 kw. Poulsen-Federal generator, Fig. 4, through the further gener-

osity of the Federal Telegraph Company. This 12 kw. generator is of ample capacity for the highest powered oscillatory circuit thus far used. The direct current for the arc is supplied by two $7\frac{1}{2}$ kw., 600 volt generators in series with their mid-point grounded.

Fig. 5 is a connection diagram of the apparatus as normally operated. It will be noted that the inductance of the oscillatory circuit is evenly balanced with respect to the capacity, and it has been found that this is essential to securing free oscillations throughout the range of frequencies employed, although there appears to be freedom of oscillation at certain frequencies when all of the main inductance is connected in one winding. The guard plates shown at the top of Fig. 5 are used to keep the strong electrostatic field of the condenser within narrow bounds, thus preventing possible injury to the insulation of neighboring apparatus. These plates are insulated from ground, but they normally "float" at approximately ground potential.

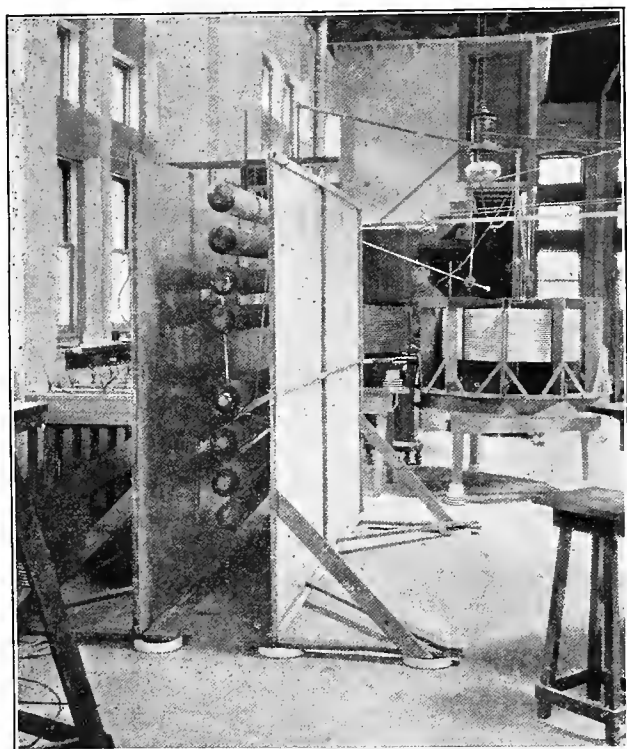


Fig. 6. Main Condenser With Guard Plates.

Fig. 6 is from a photograph of the main condenser with its guard plates. These plates are approximately 7 ft. high by 9 ft. long. The electrostatic field of the main inductance is quite well confined by the simple expedient of connecting the outer helices of both nests so that they remain at low potential. Thus, the turns which are at highest potential are not only guarded by the outer helices, but are also of smallest area and hence least able to throw out a disturbing stray electrostatic field.

When it is desired to utilize the high frequency voltage for any purpose such as testing insulation, connection may be made in either of two ways. If this voltage is tapped from points BC, Fig. 5, the maximum voltage developed in the oscillatory circuit is available, but under the disadvantage that a short circuit of the main condenser by failure of the test specimen means also a short circuit of the 1200 volt

d.c. source, thus opening the circuit breaker. On the other hand, in cases where half of the high frequency voltage will suffice for test purposes, connection may be made at AB (or CD). This connection possesses the marked advantage that a failure of the test specimen can do nothing more than short circuit one of the two main inductances while the main condenser prevents short circuiting of the d.c. source. The oscillatory circuit is thus immediately "put to sleep" as the arc is incapable of exciting the latter circuit without a readjustment of arc length to accommodate the changed inductance.

ELECTRICAL DEMONSTRATIONS.

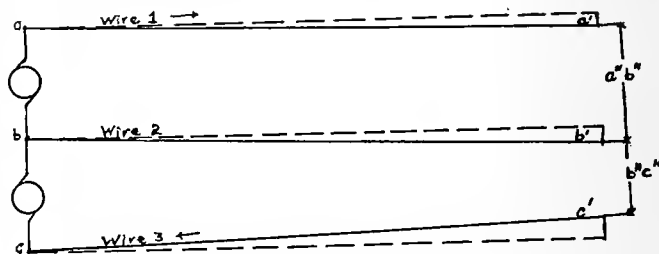
BY E. L. ARNOLD AND D. B. MUNROE.

(These demonstrations for class room work were presented as a thesis to the University of Southern California for the degree of Bachelor of Science in Electrical Engineering, and delivered as a paper at the last meeting of the Los Angeles Section, A. I. E. E., by the authors.—The Editor.)

Proposition II.—Voltages on 3-Wire System.

The object of this experiment is to graphically show voltage at any desired point on a 3-wire system with various assumed loads.

The generators are assumed, for convenience, to be connected in series and so that the positive brushes are connected to wire (1) so current will always flow in wire (1) away from the generator. Then this will necessitate that the negative terminal will be connected to wire (3) and so current will always flow towards the generator in wire (3).



Graphic Representation of Voltages on 3-Wire System.

"Electric current may always be considered as flowing down hill so that the electric level (or potential) is to be thought of as falling off along each main in the direction of the current." So the wire (a a') will always assume some position, determined by the resistance of the wire it is representing and the current flowing in that wire, lower than the original or no drop position. The same reasoning can be applied to wire (b) with the exception that the point (c) must be moved upward since that end must be higher than end (c) to allow for the drop along that wire. The distance (a') is to be moved is determined by the resistance of line represented by (a a') and the current flowing in (a a'). The product of these two will give voltage drop along (a a'). Then point (a') will take a position corresponding to this voltage drop as indicated by scale.

The same is true of the point (c') which will be moved upward an amount equivalent to the product of the resistance of the wire and the current in it as indicated on the scale.

The point (b') will be moved either up or down; the direction to be determined as explained before, by

the amount corresponding to the product of its resistance and the unbalanced current which is flowing in it.

After these new positions of (a' b' c') have been obtained the voltage which is applied across the load can be obtained by reading from the scale the voltage corresponding, in one case, to (a" b"). This is the voltage across the load between wire (1) and (2). The voltage between the wires (2) and (3) is obtained in a similar way by reading the voltage indicated on the scale between the new positions b of (b') and (c') or the distance (b" c").

The movement of wire No. (2) is determined by the direction of unbalanced current. If the unbalanced current flows towards generator, or current in (1) is greater than (3), (b') moves up. If reverse is true, that is unbalanced current flows away from generator or current in (3) is greater than current in (1), (b') moves downward from mid position (2). By varying the loads between the wires (1) and (2), and (2) and (3) different positions of (a' b' c') may be obtained and the result of this varying can be seen at a glance from the apparatus.

The effects of great unbalancing of the load can also be readily seen and the reason for the possibility, which appears at first thought to be impossible, of having a greater voltage, say for example, across (a" b") than is delivered to those lines by the generator across (a b).

All the numerical problems pertaining to the voltage drop and characteristics of unbalancing loads on the three-wire transmission can be readily shown by means of the operation of this simple apparatus.

The scope of the apparatus can be increased by having several boards similar to (a' b' c') and placing each at the point corresponding to where another load is and so by placing scale between line (a) and (b) or (b) and (c) the voltage of any point on the system can be readily determined.

Steam for atomizing oil should be dry to produce a steady white flame. Water in the steam, usually due to condensation in the supply pipe or priming of the boiler, makes the flame sputter and gives poor combustion. A steam separator or a superheater will stop the trouble.

An oil storage tank should be placed at least 2 ft. underground and 30 ft. from the nearest building, with the top of the tank below the level of the lowest pipe in the oil system. If the tank is placed above ground it must be at least 200 ft. from inflammable property to comply with the underwriters' requirements.

The "televista," seeing by wire, is a contrivance recently invented by Dr. A. M. Low of London, with which it is claimed that light may be transmitted by wire. A screen of selenium cells over which is passed a high speed motor-driven synchronously running roller consisting of alternate conductors and insulators is used as a transmitter. As selenium is sensitive to light the resulting variations are transmitted over wires to the receiver, which reproduces a flickering image by means of a similar series of selenium cells affected by the passage of polarized light through thin slats of steel.

HOW COMMISSIONS REGARD UTILITIES.

BY H. D. LOVELAND.

(This paper is in a measure a sequel to that by John A. Britton, published in these columns last week. Mr. Britton's article dealt largely with the subject of how public utilities regard regulation while Col. Loveland's paper tells how regulatory bodies regard public utilities. The author is a member of the California Railroad Commission and spares no terms in his denunciation of frenzied finance. Both talks were originally presented before the Civic Club of San Francisco. It has been slightly condensed for publication.—The Editor.)

Our opinion of public utilities today is largely the result of our experience with them, and obviously is not one that can be applied universally. Each experience with a public utility naturally gives birth to an opinion concerning that utility and any opinion expressed in general terms must be based upon the aggregate of these experiences. Such experiences have been many and varied.

When the public utilities act became effective and the real work of the commission began, there was—as was told you by Mr. Britton—a period of doubt and uncertainty on the part of public utilities. Few of them favored regulation, and those who did were in doubt as to the operation of the act under the interpretation of the California commission. Managers sought information and law departments were kept busy defining their employers' rights under the act. Their doubts, however, were soon resolved. So far as practical, rules and regulations were promulgated by the commission, which before adoption were quite generally considered at conferences between the commission, representatives of utilities and of the public. Recognition of the fact that regulation as comprehended by the public utilities act and as that act found its interpretation through the activities of the railroad commission, meant recognition and protection of the rights of public utilities as well of the people, was soon apparent, and regulation in California became an accomplished fact without serious friction. Naturally, our opinion of public utilities changed with these changing conditions.

I say that regulation became a fact in California without serious friction and that reservation is necessary. All managers of public utilities are not like Mr. John A. Britton, and all public utilities are not like the company which he represents. It is of record in the annals of our work that we were compelled to say, and did say to the president of one of the largest public utility corporations in the state that unless the reasonable requirements of the commission were observed and complied with, some one would be arrested and that it would not be a subordinate. In some instances the commission found it necessary to fine public utilities to enforce its orders and it has not hesitated to do so.

One matter, which is worthy of mention, is the disposition on the part of some public utilities to make the commission a scapegoat, so to speak. If their employes ask for an increase in wages, they are told that owing to the reduction in their income by the railroad commission, they are unable to do as they would otherwise like to do. As to almost any request which they do not want to grant, they find reason to blame the commission for their inability to grant it. This disposition is also shown by the following:

Notwithstanding the fact that the public utilities act provides who may receive free transportation upon approval of their request for same by the commission, and that the Commission in approving such requests is bound by the terms of the Act, transportation companies have frequently given as a reason for not granting transportation asked that the Commission would not permit it. Naturally, these things color our opinion of public utilities. It is only human that they should, but in simple justice to the Commission, I want to assert with all of the earnestness and emphasis at my command, that they in no way effect adversely our fair and reasonable treatment of public utilities.

Recognizing the responsibility of the great trust reposed in us, in the discharge of the duties of our position, we are actuated by but one motive, and that is to be right—fair and right to the people and to the public utilities and to clothe our work with that dignity which its importance warrants. In the language of that greatest of all American statesmen:

"With malice towards none and with charity for all, we seek to do the work as God gives us to see the right."

Mr. Britton told us that recognition was born of necessity. In that he uttered a great truth. He might have gone further and told you that all reforms are born of want and necessity. This great truth is as old as civilization. It was true when the Paladins of Charlemagne beat back the hordes of barbarians and saved to the world the remaining spark of civilization, which had steadily waned for 400 years. It was true when the Barons exacted the Magna Charta from King John, and it was true when this Republic—time's noblest offering—sprang from the womb of ages. It was true when the great emancipator struck the shackles from the limbs of 3,000,000 human beings and removed the foul blot of slavery from this earth's fairest civilization. Coming down to the immediate past, it was true when time, pregnant from the embraces of want and necessity, gave birth to the progressive movement in California and called the great leader of that movement into public life. It is true today and it will be true while the eternal hills shall stand.

Regulation of public utilities was born of necessity and that necessity in the very nature of things will continue. If any argument is necessary to convince you of the fact, Mr. Britton made it when he told you that a public utility with which he was connected some years ago with an investment of \$1800 made in a few years a million of dollars. It may well be assumed that that experience taught him, or helped to teach him, the necessity for regulation. If any further argument is necessary, let it be found in a statement made by Mr. Mellen of the New York-New Haven and Hartford Road, which appeared in the San Francisco "Examiner" June 7th:

"There is no lesson more clearly taught by history," says Mr. Mellen, "both business and political history, than the lesson that absolute power will be abused by 99 in every 100 men. The very selfishness which nature implants in us to stimulate our desire for progress makes it inevitable that we will abuse great power over other people when we have it. Probably the public does not realize that during the last 50 years, the stockholders of these great corporations have suffered even more than the public from the license which the managers and outsiders, who controlled the managers of these corporations, have enjoyed."

Mark you, he says. "The license which they have enjoyed," and when you remember that the stock and bonds of these corporations are largely held by the public, it must be evident to you that some regulation is necessary to prevent the exercise of such license.

But it was not the John Brittons and the Jesse Lilienthals who made regulation of public utilities necessary. It was men of a different sort. Managers and directors, who believed, and still believe in what they regard as the divine right of wealth to exploit the many for the benefit of the few, and in the ranks of public utility directors and managers there are many such; and were it not for regulation, for every Britton and every Lilienthal, there could be found a dozen Mellens and a score of Calhouns, who would be willing to nail to the masthead the slogan "The Public Be Damned," and sail their ship in any sea on any course where profit was greatest. These are the men who object to regulation. And so I say, regulation must continue; continue along conservative, sane and reasonable lines, and never for a moment should regulatory bodies lose sight of that cardinal truth that regulation and prosperity should go hand in hand.

Capital will not and should not be expected to risk investments in public utilities and receive only such returns as may be had from mortgage investments. Returns should be liberal, and in building up public utilities when the risk of loss is great, the returns upon the investment should be correspondingly large. Also reasonable promotion fees should be recognized and allowed in the origin and development of public utilities to the end that the intelligence of those who possess the power of initiative may be used for the progress and development of our country. Such has been the earnest endeavor of the California Commission. Yet, in justice to the Commission, I must add that we also take into consideration the question as to whether the promoters of public utility enterprises are willing to risk their own money, or whether they desire to borrow the entire investment from the public through bond issues and then expect the public to pay such rates as will enable them to meet bond interest and put aside a sinking fund to retire bonds at maturity, while they own the property thus developed through stock ownership. This has been an attractive method of financing public utilities in the past and all too often such enterprises—capitalized without restriction—have been forced into reorganization to the material loss of those who invested in their securities.

To epitomize the position of the Commission briefly, I desire to quote from a decision recently issued by the Commission:

"For what happened before the Public Utilities Act became effective, the Commission is not responsible. The most that the Commission can be expected to do now is to see that by none of its acts does the condition of utilities become worse than it was before March 23, 1912. When a utility which has been improvidently and recklessly financed prior to March 23, 1912, comes before this Commission, the Commission will seek to compel the utility to better its financial condition instead of making it worse. And while the Commission must perforce permit for a while many conditions to continue which it would never have sanctioned initially, it will constantly strive to bring public utility financing more nearly to the level which it should have assumed from the start."

Frequently also through misconception in the beginning of what could be accomplished, or through mismanagement, public utilities fail to produce returns upon investments and holders of security lose. Such failures create mistrust in business and financial circles, with the result that the injury they cause cannot be measured by the pecuniary loss of those who hold securities in such utilities.

This brings me to another matter that I especially want to call your attention to. As you are aware, we are experiencing a period of financial depression, which though seemingly wholly unwarranted, seems to recur with more or less regularity in this and other lands. Probably every man within sound of my voice can recall one or more such periods. In the past, tariff legislation or currency reform movements have been popularly assigned as the cause of such periods. Today regulation of public utilities is being blamed, although we have never seen more drastic tariff and financial legislation than has been enacted during President Wilson's administration. All of this has been, and is being, ignored by the public utilities which are desirous of moulding public opinion adverse to regulation. Already there are whispers that regulation is hurting business in California. Already the Interstate Commerce Commission is being criticised in the columns of papers and periodicals—such utterances in my judgment being inspired by directors and managers who do not take kindly to regulation. The reason is obvious to any thoughtful mind, coming as these utterances do at a time when the Federal Commission is considering the request of the interstate carriers for a horizontal increase of 5 per cent in freight rates. It may be that owing to the alleged increase in the cost of operation, which, however, is not admitted by some, and the reduction in rates by Commissions, some increase in transcontinental rates is really justified, and if so, it should be granted. The prosperity of our country is indissolubly bound up with and dependent upon the prosperity of our great arteries of transportation, but there are two things I want to call your attention to in this connection.

Of one premise I am perfectly sure, and that is—that instead of regulation having caused the present financial depression, it is the result of lack of regulation in the past, the reckless inflation of values and the issue and sale of watered securities upon which returns cannot now be paid; in other words, the gross and often dishonest management of public utilities, which proper regulation would have prevented. The other thought is that if trust-made and trust-controlled merchandise were compelled to pay the same rate of freight that the people pay generally, the necessity for an increase in rates might not be as keenly felt.

Referring again to the fact that regulation is being blamed and will be blamed for hurting business and bringing about hard times, let me remind you that recurring periods of financial uncertainty and resulting depression in business activities, or what is familiarly known as "hard times," were a part of the history of this and other countries long before regulation of public utilities was known.

Instead of regulation hurting business, and particularly the interests of public utilities, let me cite two

instances which have recently come within the knowledge of the Commission, that regulation is a help rather than an injury: Recently a representative of a large bond house in this city came to the Commission and showed us a letter which his firm had received from one of the great bond houses of London. In the letter occurred this paragraph:

"Please obtain for us whenever possible California securities which have been approved by the Railroad Commission of California."

Another instance occurred in connection with what is known as the "Oro" case. The Western States Electric Company was serving the City of Stockton with electric energy and an application was received from the Oro Electric Company for a certificate of public convenience and necessity to enter and serve the same city. After an exhaustive investigation and hearing, the Commission denied the application of the Oro Electric Company on the grounds that public utilities should be protected when giving efficient service at reasonable rates. The case was appealed to the Supreme Court and that august body overruled the decision of the Commission. The following morning a telegram was received from one of the large bond houses in New York asking the Commission to give them the status of the case, as California securities had been very attractive under the ruling of this Commission, but that if the position taken by the Commission that utilities should be protected as well as regulated was not to be approved by the courts, California securities would be less attractive.

Just one word more as to regulation injuring public utilities. I shall not mention names, but you will readily understand the utility to which I refer, for the reason that it has been much in the public eye recently. A utility which cost \$20,000,000, immediately capitalized for \$80,000,000, with an earning capacity of \$8,000,000 and expenses of approximately \$4,000,000, was compelled to apply to the Commission for permission to issue notes or equipment certificates to procure necessary equipment. Do you think for one moment that that utility, under wise and reasonable regulation, would have found itself in that position? Your answer springs unbidden to your lips, and I feel assured that you will say as I do that it was the lack of regulation and the frenzied methods of finance resulting from such lack of regulation that prevented that utility from having ample means to thoroughly serve the public and pay handsome dividends upon legitimate capitalization.

I must apologize for straying away from my text, but all of these thoughts really have something to do with our opinion of public utilities. To sum up, then, we regard public utilities as necessary to the growth and development of our complex twentieth century civilization. We believe that regulation and protection should be concomitant and that public utilities should be fostered, protected and regulated when necessary.

Fuel oil strainers, made of wire netting or perforated metal, are necessary to insure that the burners are not clogged by sand or dirt in the oil. They should be made and put in so that they can be quickly and easily cleaned.

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ON LIBRARY CARS OF ALL SOUTHERN PACIFIC TRAINS

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Nature endowed this west coast of America with great mountain ranges whose lofty peaks condense the moisture raised by the sun from the sea and give opportunity for the water to again go down to the sea. For countless ages this continuous cycle was commercially useless. Here was pristine nature, the passive factor in production, an aggregate of materials and blind forces, destroyed as readily as created.

The Water That Goes Down to the Sea

Enter man, the active factor in production. By brawn and brain he marshalled the materials and directed the forces. He employed the water to wash the gold from the gravels in the high lands, then to irrigate the soil in the low lands, and later to turn the wheels of industry. Thus were the two primary factors of production conjoined to increase the utility of water.

Finally came capital, the resultant of these primary active and passive forces, the product of past industry, first aid to future production.

But because capital is thus a secondary factor, certain would-be reformers, ignorance alike of the fundamental principles of mechanics and economics, are trying to destroy this secondary of the transformer which steps up industry to wealth. Its flow through normal conductors has been checked and as a result labor is idle, material useless and production stopped.

The Oregon Hydroelectric Commission conservatively estimates that at least three million horsepower is running to waste in that state because its other natural resources have not yet been developed by capital. Here is a territory capable of supporting millions of prosperous people if capital can be attracted.

But what are the facts? Capital is being repelled, when not destroyed, by restrictive legislation and governmental competition. Water power development is being discouraged. Although past evils have been corrected, yet the pendulum is being swung still further to the nether extreme. Surely the time has come to cease the persecution of capital and to utilize the water which is now uselessly going down to the sea.

The laying of a second power cable across San Francisco Bay sets another record for the West, this being the largest and longest submarine cable in America. This last link in the 150-mile transmission of power from the Sierras to the sea was successfully completed during the past month. The Great Western Power Company has created larger storage capacity by building the Big Meadows dam, has installed new generators in the Big Bend plant, and by the completion of the cable crossing is thus able to replace fuel oil with water power for its San Francisco system.

San Francisco offers many physical obstacles to the entrance of power. Situated at the extreme end of a narrow peninsula, the first high tension transmis-

Another Record Breaker

sion lines reached the metropolis by means of long detours through a region where heavy fogs and consequent troubles are frequent. An aerial crossing not only presented great engineering difficulties, but also was forbidden by the War Department. The San Francisco & Sierra Power Company spanned the bay by a tower line south of Dumbarton Point, where shallow water made concrete foundations possible. Finally the Great Western Power Company cut the Gordian knot by laying an 11,000 volt cable in 1912, which has given such excellent service as to justify this new cable.

One of the most interesting features in connection with the installation were the ingenious methods adopted by the contractor. The first cable had been spliced on shore, and required a great barge of a half million pounds displacement, together with three tugs for its maneuvering. By adopting the expedient of splicing the cable on the barge a small float and gasoline launch sufficed. The traction cable of the old Geary street road continues its useful life as the messenger for the power cable, and the barge was anchored by a cable grip from one of the old cars. The great value of the article on this subject, as printed elsewhere in these columns, are the illustrations of each step in splicing a cable, and to those interested in such work this article is commended.

Good will is an intangible asset whose very vagueness vitiates its value. Because it cannot be felt, seen, heard, tasted or smelled, because it defies measurement by the yard-stick or pint cup, because it cannot be weighed in the balance, it is to be thrown on the scrap-heap as worthless. That which the individual values perhaps higher than anything else in life, the good opinion of his fellowmen, is valueless to an aggregate of individuals banded together for the service of their fellowmen.

Such in brief is the substance of legal decisions regarding the good will of a public utility corporation.

From time immemorial business enterprise has been rewarded by the patronage of those having confidence in the excellence of its service. Millions of dollars have been paid for businesses whose physical values—"furniture and equipment"—were but a small part of their earning power. Consider a newspaper, the practice of a professional man, or a trade-marked article of merit which has been extensively advertised. The public service corporation is denied such reward.

Good will is as an essential part of the worth of a corporation as is the spirit which actuates the body of a man—and fully as valuable. Without it, physical equipment is of small avail. It may be defined as the integral of the confidence felt by individual consumers. Confidence in turn is the first derivative of personality with reference to service. These three factors—confidence, personality and service, the basis upon which all successful businesses have been built, and the result of an expenditure of thousands of dollars in creating a favorable public opinion, are of no value to the public service corporation for rate-making purposes.

The reason assigned is that the utility is usually a monopoly; under ordinary conditions the will of the consumers, whether good or ill, makes little difference in the amount of the utility consumed; "a monopoly has no good will, for its customers are retained by compulsion, not by their choice."

So it is seen that good will must be predicated upon competition—present and active. It makes no difference how intense the competition may have been before the monopoly was formed, it matters little if other utilities are fiercely competing with that controlled by the monopoly, whether fuel oil is supplanting gas for domestic use, or the wireless telegraph replacing the established system, the good will of the corporation which has survived past competition, and holds present consumers, cannot be capitalized.

Occasionally when the shoe pinches the other foot, the public at large is made to realize the inequity of these rulings. Recently a Western city desired the use of certain valuable privileges belonging to a private corporation. In return for their use the municipal authorities offered their good will with the railroad commission. "A good thing to have," you will say—but of what worth if it cannot be capitalized? What man versed in the uniform methods of accounting prescribed for public utilities would allow such an entry on the books of the corporation? The corporation has no competition; hence its good will has no value. "Even under competitive conditions good will cannot be considered in the valuation for rate regulation," says the Wisconsin Railroad Commission.

Consequently, if the corporation is compelled to concede the worthlessness of its good will asset from a rate-making standpoint, should not the rate-making body stand as a protecting bulwark against a possible ill will liability which too frequently forces rates below a profitable level? Otherwise there is little incentive for promptness and courtesy in public dealings, voluntary reduction of rates when conditions justify, or a consideration of the welfare of employes—those factors which build up good will.

Although this feature cannot be included in the assets of the corporation for rate-making purposes, it actually constitutes a valuable part of the corporation worth when its property is for sale. Yet how easily can this good will be broken down by unscrupulous parties who might desire to depreciate the corporation's securities. So one of the chief functions which a public service commission has to perform should be that of protecting the companies which submit to its jurisdiction.

Yet the Railroad Commission of California not only disallows capitalization of good will, but even "regards with extreme suspicion" that well-recognized and established element of appraisal known as going concern value. Submitting, for the sake of argument, to the Commission's late decision regarding the unreasonableness of the rates of the Coast Valleys Gas and Electric Company, is the natural divergence of opinion regarding these intangible elements sufficient grounds for the insinuation "that the value of engineering aid in rate fixing is much over-estimated, or that one or the other engineer * * * is mentally dishonest"? What say you?

PERSONALS

R. H. Baillard, secretary and assistant general manager of the Southern California Edison Company is at Lake Tahoe.

H. L. Jackman, manager of the Western States Gas & Electric Company, Eureka, was at San Francisco during the past week.

S. Herbert Lanyon, Portland representative of Pierson, Roeding & Company, has been spending the past week in San Francisco.

C. M. Means, electrical engineer, of Pittsburgh, Pa., has been appointed consulting electrical engineer with the U. S. Bureau of Mines.

Max Loewenthal, president and manager of the United Electric Stores, Inc., of Los Angeles, was in San Francisco last week on business.

W. J. Grambs, assistant to the President of the Puget Sound Traction, Light & Power Company, has returned to Seattle from San Francisco.

Wm. H. Onken Jr., managing editor of the Electrical World of New York City, is looking over the new developments in the West since his last visit.

F. H. Gale, advertising manager of the General Electric Company, Schenectady, and Miss Gale, on an extended trip of the Pacific Coast, arrived in San Francisco from Southern California during the week.

F. M. Farmer, chief engineer of the Electrical Testing Laboratories of New York City, is visiting the Pacific Coast, now being at Seattle, after visiting Salt Lake City, Los Angeles, San Francisco and Portland.

C. V. Schneider and **J. C. Rendler** have been appointed directors of the California State Contractors' Association, and are to represent the association at the National Contractors' Association convention, Detroit, July 15-18.

S. J. Lisberger, engineer of electrical distribution, and **F. H. Varney**, steam-electric engineer of operation, Pacific Gas & Electric Company, have returned to San Francisco from the N. E. L. A. convention at Philadelphia.

F. W. Emery, **A. M. Roberts**, **W. A. Morey** and **L. A. Porter** have been appointed by the city of Lewiston, Idaho, as a power plant board to investigate the question of securing a site on Clearwater river for a municipal power plant.

H. B. Squires, of the firm of H. B. Squires Company, San Francisco, has left for a month's trip throughout the East, during which he will visit the various factories he represents and expects to make the return trip by way of the Northwest and Portland.

A. M. Hamblett, chemical engineer with Whitney & Company, Boston, who has been in California for some months, in connection with the Electro-Alkaline Company's plant in Oakland, leaves for Sweden shortly, on business for the Boston concern.

Jos. M. Berkeley has been appointed superintendent of the gas department of the Southern California Edison Company of Los Angeles, succeeding **H. W. Burkhart**, who recently resigned to take up private practice as announced in these columns.

H. E. Sanderson, Pacific Coast manager of the Bryant Electric Company has just returned to San Francisco after an extended business trip of several weeks through the Northwest, including Portland and Seattle. Mr. Sanderson reports brighter business conditions in this section.

Prof. James G. Scrugham has been appointed dean of the department of engineering at the University of Nevada. This newly created department includes the colleges of min-

ing, electrical, mechanical and civil engineering. Prof. Scrugham has also been appointed special commissioner in charge of the Nevada exhibits at the San Francisco and San Diego expositions.

Edward A. Quinn, formerly representative of the Allis-Chalmers Company, has been appointed to fill the vacancy in the position of general superintendent of the San Joaquin Light and Power Company recently caused by the tragic death of **L. N. Peart**. Mr. Quinn has had a wide and varied experience in electric construction and operation, having been associated from time to time since 1893 with the Chicago Edison Company, the Edison Light and Power Company of San Francisco, the Standard Electric Company of California and the Nevada-California Power Company, with which latter concern he was general superintendent from 1907 to 1910. Furthermore, his experience with the Westinghouse Electric and Manufacturing Company and the Allis-Chalmers Company have eminently qualified him for his present position, in which his many friends join in wishing him success.

John Sandberg, special appliance salesman of the General Electric Company, has returned from a month's work in Idaho, where he has been co-operating with **Julius Derge**, in charge of appliance sales for the Utah Power & Light Company, in an extensive selling campaign of electric ranges and cooking appliances. They visited practically all of the important towns on the Utah Power & Light Company's system in southern Idaho and carried with them a complete equipment which was set up at some convenient store or hall, for demonstration purpose. Their coming had been extensively advertised by the company's local representatives and the patrons from the town and from the surrounding territory came in great numbers to witness the demonstration. Messrs. Derge and Sandberg express complete satisfaction with the results secured. A great many orders were taken for ranges and for heating and cooking appliances and much interest was stimulated among the well-to-do farmers, which will undoubtedly result in sales later on.

MEETING NOTICES.

Jovian Electrical League of Southern California.

The last meeting of the season of the Jovian Electrical League of Southern California was held at Christopher's on June 24th, and in accordance with tradition, was attended by about 150 loyal Jovians. The meeting was in charge of **L. S. Granger**, and after the rendition of a splendid musical program, a talk on "Personal Efficiency as a Science" was given by **Dr. Charles W. Hall**, the Pacific Coast representative of the American Institute of Efficiency. Dr. Hall gave a very practical talk on business efficiency, citing as a slogan the words—"Analyze, don't guess." He said that the difference between the former scientific manager and the present efficiency expert is that the former tried to squeeze profit out of labor, while the latter takes into account the human equation. Dr. Hall enumerated the following essentials in applying efficiency methods: Records, Planning, Schedules, Despatching, Standardizing Conditions, Standardizing Operation, Common Sense, Competent Counsel, Fair Dealings, Discipline, Efficiency Reward.

He laid great stress on the statement that procrastination, besides being the thief of time, was also a slayer of character, and that to make good use of one's twenty-four hours differentiates the efficient man from the hobo. He claimed that there was no doubt that the successful man is efficient, and the efficient man generally successful. In quoting **Mr. Harrington Emerson**, he said in conclusion, that there is no obstacle so great that there isn't some way around it, or under it, or over it, or straight through it.

The Jovians then elected **Mr. Dick Alter** of the Edison Company and also of the Garrick Theater, an honorary member of the League, and appointed him the official Jovian pianist.

TRADE NOTES.

The board of public works of Seattle has awarded to the Allis-Chalmers Company a contract for furnishing transformers at a cost of \$10,500.

W. R. Pounder, Pacific Coast manager for Hubbard & Company, has removed his offices from the Williams Building to 401 Rialto Building, San Francisco.

H. N. Lauritzen, Pacific Coast manager for the Holophane Works of the General Electric Company, reports an increased business for the past month, which usually mark a decline coincident with the summer season of small lighting business.

The East Oregon Lumber Company has purchased 120,000,000 ft. of timber in the Wallowa national forest from the government. A mill will be erected at Enterprise and a tap line railroad is to be constructed at once. C. D. Logan is to have charge of operations.

The Power Equipment Company, Rialto Building, San Francisco, have been awarded the contract for the Sacramento Sewage plant No. 2. The electrical equipment will be of General Electric Company manufacture and the pumping equipment will be supplied by the Worthington Pump Company.

The Portland Gas & Coke Company has awarded the contract to the Camden Iron Works, of Camden, N. J., for the construction of a gas holder to be built on Milwaukee and Clinton streets. The structure will have a capacity of holding 2,000,000 ft. of gas and will be the largest in Portland. The entire structure will be of steel with the exception of the concrete foundations. It will be 150 ft. in diameter and 175 ft. high. The cost is placed at \$30,000.

Eardley Bros., the enterprising firm of electrical contractors of Salt Lake City, had as their guests the employees of their company at a strawberry and dancing festival Thursday evening of last week. The company slogan, "Let Eardley Bros. Do It If You Want It Done Right," is an ample guaranty that the evening was a most enjoyable one. Further evidence could be secured from any of the company's employees who voted the affair a highly enjoyable one.

The new substation of the California-Portland Cement Company at Colton, Cal., is nearing completion. The building is of concrete construction and is thoroughly modern in every particular. Three 1500 kw. transformers are to be installed in this station to take the place of the three 800 kw. now in use at this plant. There are also motors totaling approximately 2500 h.p. now on the ground which are to be installed in the immediate future to supplement the present equipment.

The Southern Pacific Company has given The Electric Storage Battery Company of Philadelphia an additional order for 650 sets of "Ironclad-Exide" Batteries for locomotive head-light service. With the previous order received several months ago, this makes a total of 946 sets—2838 cells—of Type 13 MV "Ironclad-Exide" which will be used in this class of service by the Southern Pacific Company. The ruggedness of this type of battery, its long life and the fact that it can be operated for much longer periods without cleaning than any other type, make this battery peculiarly adaptable to the severe service requirements in this class of railway work.

The General Electric Company has recently issued Bulletin No. 41302, which covers the complete line of G-E Standard Polyphase Induction Motors. The characteristics of the different forms of these motors are analytically described, and the windings used for various classes of service are shown. Every effort has been made to include information which will be of value to the operator of G-E motors, and dimension drawings of motors and compensators are shown. Bulletin No. 46201 illustrates and describes the Type I-14 Single-Phase Watthour Meter for which is claimed high initial and sustained accuracy, wide range of capacities and low cost.

The Pacific Power & Light Company has obtained contracts to furnish power to the two large dredging companies which will soon begin operations near Astoria, Oregon. These companies are the Tacoma Dredging Company of Tacoma, Wash., and the Standard American Dredging Company of Oakland, Cal. These two projects are known as the "Reclamation" and the "City" contracts. Each company will use 600 kw. of energy delivered at 2300 volts. The Hammond Lumber Company will install a 1000 kw. General Electric steam turbine and generator to furnish this power. The Pacific Power & Light Company buy the power wholesale from the Hammond Lumber Company and retail it to the dredges.

The Westinghouse Electric & Manufacturing Company reports the receipt of the following orders from the Pacific Coast: Pacific Gas & Electric Company, San Francisco, Cal., 1-1000 kw., 650-volt, 6-phase, 60-cycle, 600 r.p.m. rotary converter; 5-1000 kw., 650-volt, d.c. generator on common base and shaft with 5-1440 h.p., 11,000-volt, 3-phase, 60-cycle, 514 r.p.m. synchronous motor. Northwestern Electric Company, Portland, Ore., 1-75 kw., 125-volt generator on common base and shaft with 1-2200-volt, 3-phase, 60-cycle, 1170 r.p.m. induction motor, and 1 switchboard for same. Pacific Gas & Electric Company, Oakland, Cal., 1-1000 kw., 600-volt generator on common base and shaft with 1-1440 h.p., 11,000-volt, 3-phase, 60-cycle, 514 r.p.m. synchronous motor generator. Pacific Light & Power Corporation, California, 2-500 kw., 2 bearing, synchronous motor generator sets consisting of 2-500 kw., 225-112½-volt, 3-wire commutating pole generators, 500 r.p.m. mounted on common base and shaft with 2-720 h.p., 3-phase, 50-cycle, 2400-volt, 500 r.p.m. synchronous motors.

The San Francisco & Oakland Terminal Railways have placed their order for a new ferry boat to run between San Francisco and Oakland, with the Moore & Scott Iron Works. The general dimensions of the new boat are to be: 230 ft. long over all, 218 ft. between perpendiculars, 63½ ft. beam over guard, 42 ft. beam moulded, 19½ ft. depth moulded. The hull is entirely of steel and will have six water tight transverse bulkheads, and two longitudinal bulkheads, making the vessel non-sinkable in case of collision. The boat is designed to carry from 2500 to 3000 passengers. The machinery will consist of compound engines with four cylinders; two high pressure, 20 inches diameter, and two low pressure, with 42 in. diameter, all with a common stroke, 28 in. The vessel will be fitted with four B. & W. water tube boilers, with Moore & Scott oil burning system. The vessel will have a speed of fifteen miles per hour. She will be built at the Moore & Scott ship yard, Oakland harbor, at a cost of \$305,000, and will be ready to take her place on the bay run on March 26, 1915.

The municipal fire alarm department of Portland, Oregon, is installing a complete "Semaphore System" on the intersection of the streets where the greatest congestion of traffic exists. All of this apparatus is operated by a key-board in the fire alarm central station. When a fire alarm is sent in the "semaphores" are operated and an arm with the word "FIRE" is extended into the street at the same time a bell or horn is operated, calling attention to the extended arm. In this way the fire department apparatus obtains a clear right of way which saves a great deal of time. The control circuits are operated by 28 volts from the fire alarm storage battery. The energy for operating the mechanism in the semaphore posts is a.c. or d.c. 110 volts., taken from the lighting system. At present only 7 equipments have been purchased, the same being of 3 manufacturers. The purpose being to select the best of these equipments in order to purchase the balance of the equipment. At present the equipment installed are as follows: Union Switch & Signal Company, d.c. and a.c. equipments; General Railway & Signal Company, d.c. and a.c. equipments; Hall Switch & Signal Company, two d.c. and one a.c. equipments.

NEW CATALOGUES.

Gas Engines are fully dealt with in a beautifully illustrated descriptive catalogue published by the National Transit Company, Oil City, Penna.

The Western Electric Company has issued an attractive publication entitled "The Making of the Voice Highways," which is descriptive of the manufacture of lead covered telephone cable.

Pawling & Harnischfeger Company, Milwaukee, Wis., has issued Bulletin 301A, to show the application of the Electric Hoist in the industrial handling of such materials as paper, pipe, plates, etc.

Steel-Tape-Armored Cables are described and much interesting information given regarding same in Bulletin No. 680-1 now being distributed by the Standard Underground Cable Company, Pittsburg, Pa.

Wagner Electric Manufacturing Company is distributing a handsome calendar, printed in colors and depicting the satisfaction of a boy in inspecting a Wagner motor. It bears the trite and appropriate cover "What is so rare as a day in June, for a new calendar."

Dielectric Manufacturing Company of St. Louis, is distributing a booklet of "Data on Dependable Insulation." The contains curves, tables and descriptive details of the several kinds of varnishes, compounds, and other insulating materials which this firm manufactures.

The Standard Underground Cable Company of Pittsburg, Pa., has published a condensed folder on Standard Wires and Cables, and Cable Accessories. The bulletin is handsomely printed in colors, and gives information of particular value to those interested in underground distribution.

"Western Electric Inter-Phones and Accessories" is the title of an attractive bulletin from the Western Electric Company. Descriptive details and prices are given of many types of intercommunicating telephones for office, industrial and home use. The diagrams are an interesting and valuable feature of the bulletin.

Bulletin 105, Wagner Electric Manufacturing Company of St. Louis, is devoted to central station transformers. Details of construction are graphically shown by pictures, and clearly portrayed by text. Valuable directions for core loss tests, copper loss, temperature rise and efficiency, are given. This bulletin constitutes a valuable text for all interested in transformers.

Porcelain and Glass Insulators are thoroughly described and illustrated in Catalogue Section DS845 just issued by the Westinghouse Electric & Manufacturing Company. The booklet gives a large number of sectional drawings with the voltage ratings. The different kinds of insulators such as the pin type for poles, pin type strain insulators, transformer bushings, roof entrance bushings, outdoor type transformer bushings, floor and wall tubes and knobs are all covered.

Publication No. 1531 from the Westinghouse Electric & Manufacturing Company, is concerned with Westinghouse Wicker-Type Electric Linotype Pots. Illustrations are given of installations, and details of construction and operation are shown. Folder No. 4277 from the same company, entitled "Drawing the Crowd and Keeping It," shows the use of Westinghouse flame carbon arc lamps, Cooper-Hewitt A. L. rectifier outfits, Westinghouse electric fans and ozonizers in meeting this purpose for moving picture enterprises.

The Westinghouse Electric & Manufacturing Company has recently issued Section 3164 covering Motor-Driven Laundry Machinery. This forms one of the series of publications which this company is now issuing dealing with motor drive as applied to various industries. The booklet is well illustrated, describes the qualifications necessary for motor drive in this class of work, and shows a number of installation views. A number of installations are also described showing the amount of power required for the various machines and also the monthly consumption of different plants.

BOOK REVIEWS.

Electricians' Wiring Manual. By Frank E. Sengstock; 406 pp.; 4½x6½ in.; 414 Illustrations; leather. Published by Popular Electricity Publishing Company, Chicago, and for sale by Technical Book Shop, San Francisco. Price \$1.50.

Of the many books on electrical contracting this text comes nearest to the ideal of a simple, practical, working set of directions on how and why to wire an interior job. The author is electrical inspector with the Chicago Board of Fire Underwriters and displays a thorough knowledge of the practical details of electrical contracting. The descriptions and directions are so plain that the rawest apprentice can follow them, yet the experienced master electrician will find many new hints and kinks of value. The book has twenty-seven chapters, the first part being concerned with tools and materials and their use in wiring typical jobs. The chapters on estimating and specifications are especially good. The usual tables and formulas are given, simplified explanation of electrical theory and some excellent suggestions on wireless telegraph installations. The last, but not least of the excellent features is a complete index.

Oil Fuel for Steam Boilers. By Rufus T. Strohm; 145 pp. 4½x7 in.; cloth. Published by McGraw-Hill Book Co., New York and for sale by Technical Book Shop, Crossley Building, San Francisco. Price \$1.00.

Notwithstanding the wealth of information that has been published in this and other journals about burning fuel oil, there are few texts which give this subject adequate treatment. Mr. Strohm has compiled some of this matter in handy form in this little volume. Regarded merely as a compilation the work has been carefully and judiciously done. But in the light of practical experience this text can be greatly enlarged and improved. The treatment is confined to stationary steam boilers, and gives no details of important marine developments. Much of the material has apparently been obtained through correspondence and little knowledge is exhibited of approved Pacific Coast practice. The several subjects treated include principles, form and action of different burners, furnace arrangements, pumps, heaters, cleaning devices, storage, purchase and management. In the final estimate, its virtues outnumber its faults and the book will prove a valuable guide and reference for those concerned with the economical use of fuel oil under boilers.

The Job, The Man, The Boss. By Dr. Katherine M. H. Blackford and Arthur Newcomb; 266 pp.; 5½x8 in. Published by Doubleday, Page & Co., New York City and for sale by Technical Book Shop, San Francisco. Price \$1.50.

In these days of efficiency and scientific management, there is no detail of business organization which is not being analyzed and classified. The authors of this text have made a signal success in employing workers for large concerns and have here summarized the results of their investigation for the use of others. While the treatment is largely based upon the work of earlier physiognomists, many facts of interest and value have been brought into convenient form. The business is not that of fitting round pegs to square holes, but of differentiating the round pegs from the square pegs and finding apertures into which each can be fitted. As the face is the spot where that which we call mind comes the nearest to the surface of that which we call matter, a scientific classification of facial peculiarities furnishes the most satisfactory index of character. The suggestion is made that hiring and firing of employees be placed in charge of a competent man or woman with sympathy, tact, observation and understanding of human nature. Full details as to the organization and conduct of an employment department are given, together with illuminating chapters on discipline, handling men, educating employees and vocational guidance. While some may doubt the full dependability of this information none can question its general value in guiding the selection of employees. As such it is a notable contribution to business literature which should be read by every employer if for no other reason than to avoid the stigma of poor management which is invariably associated with frequent discharges.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The commission has authorized the Long Beach Consolidated Gas Company of Long Beach, Los Angeles county, to use the proceeds of the sale of 1060 shares of its preferred stock for the purposes of paying a promissory note amounting to \$40,000 held by the Southern California Edison Company and open accounts payable amounting to \$611.99. The gas company was authorized to issue this capital stock by a decision of the commission dated May 23, 1914.

The Pacific Gas & Electric Company filed an application with the commission for authority to issue \$12,500,000 of first preferred stock and \$5,000,000 of its general and refunding bonds. The company proposes to sell the stock at \$82.50 per share. The company asks for authority to sell the bonds at a future date at a price to be determined later. The Pacific Gas & Electric Company has taken steps to amend its articles of incorporation so as to provide for the issue of first preferred stock. The company desires also authority to convert its present issue of \$10,000,000 of preferred stock into first preferred stock after July 1, 1916, at the rate of 1.025 shares of first preferred stock for each share of the present preferred stock. The new first preferred stock, which the company proposes to issue will be 6 per cent cumulative.

The Ojai Power Company has been authorized to operate an electric light, power, water and distributing system in and about Nordhoff in the Ojai Valley, Ventura county, and to issue capital stock of the par value of \$19,200. The proceeds derived from the sale of this stock are to be used for new equipment and the betterment of the present system. It is made a condition of the commission's order that the stock shall be issued by the Ojai Power Company at par.

The Central California Gas Company has been authorized to issue bonds of the face value of \$15,000 and common capital stock of the par value of \$10,000. The bonds will bear interest at the rate of 6 per cent per annum payable semi-annually and will be secured by a mortgage executed by the Central California Gas Company to the Los Angeles Trust & Savings Bank as trustee. It was made a condition of the order that the bonds shall be issued so as to net not less than 90 per cent of their face value in cash plus accrued interest, and the common capital stock so as to net not less than 80 per cent of its par value in cash.

The commission has rendered a preliminary order in the applications of the San Francisco-Oakland Terminal Railways for permission to issue additional bonds and notes. The applications now pending before the commission ask authority to issue the following: \$1,000,000 of general lien bonds to be pledged together with other collateral already pledged as security for an issue of outstanding notes; 500,000 of notes additional upon the collateral so pledged; 10,000,000 of first and refunding bonds. In rendering a preliminary order on these applications, the commission did so upon the representation that certain pressing obligations must be met by the railway company and because the physical valuation of properties now being made by the commission may not be completed before another 60 days. The obligations which the railway company desires to meet immediately include a preliminary payment of \$60,000 on a new ferry boat to be used in carrying passengers from Oakland to the exposition grounds in San Francisco during 1915, and an initial payment of \$100,000 on new street cars for the city of Oakland. The preliminary order of the commission permits the San Francisco-Oakland Terminal Railways to issue its promissory notes for a period not to exceed one year in a sum not to exceed \$650,000. It is also given authority to issue \$1,000,000 of its general lien bonds as collateral security for this issue of notes.

The San Joaquin Light & Power Corporation of Los Angeles has filed an application asking authority to renew notes totaling \$139,967.13. The notes are to be renewed for a term of one year from date of maturity.

NEWS OF THE OREGON RAILROAD COMMISSION.

The Home Telephone & Telegraph Company has been granted permission to raise most of its rates in Medford, Jacksonville, Gold Hill and Rogue River to the approximate basis of \$2.00 for one party residence and \$3.00 for one party business instead of the \$2.50 and \$3.50 requested respectively. In granting the application for increase the commission said:

If the commission should grant authority for the Home Company to increase its rates to the extent prayed in its original or amended applications, Home Company would lose a large number of subscribers who are now patrons of its exchanges, without gaining any subscribers in place thereof; and the effect would be to decrease the number of subscribers connected, to diminish the value of service to the existing subscribers and not to increase the gross or net revenues of the company in proportion with the increase of rates. It is not possible, either by the schedule of rates applied for, or by any schedule which the commission can name, to yield to the company its present unduly high operating expenses, its taxes, depreciation, and any substantial return upon the investment, for the reason that any rates which would yield such return would be so large that the same would exceed the value of the service to the patrons and would be unreasonably high, and the applicant would in consequence lose so many subscribers that neither its gross nor net revenues would be increased.

With regard to the complaint brought by the city of Cottage Grove against the Cottage Grove Electric Company, the company was ordered to remedy its voltage fluctuation, to inspect incandescent lamps used in municipal lighting weekly, to replace lamps which have reached the limit of their efficiency and at all times to keep the lamps clean and in proper condition for efficient service. The complaint that over 100 kw.-hr. is too high, was dismissed until a further test has been made of its operation. Evidence shows that the complaint that this meter charge is higher than the flat rate charge for the same service is not justified, the contrary being true.

The case of the Corvallis Independent Telephone Company vs. The Pacific Telephone & Telegraph Company, wherein an increase of rates is sought for both plaintiff and defendant, is set for hearing on July 8th at Corvallis.

Arizona Corporation Commission.

The original order of the commission in the case of the city of Tucson versus the Tucson Gas, Electric Light & Power Company, was amended to agree as regarding lighting rates and annual charges for street lighting business so as to be more just to the lighting company which had appealed in the Superior Court that the rates and charges first ordered be set aside. The new schedules are satisfactory to all concerned and the case before the Superior Court has been dismissed.

PUBLICATIONS RECEIVED.

California State Mineralogist F. McN. Hamilton announces the publication of Bulletin No. 67, "Minerals of California"—available for distribution July 1, 1914. Price \$1.00. This work which is a cloth bound volume of 250 pages, has been written by A. S. Eakle, Ph. D., Professor of Mineralogy in the University of California, and is the result of many years of research and study of the minerals of the state. Each chemical group of minerals constitutes a chapter in the book, for instance, Chap. I—Native Elements; Chap. 11—Sulphides, etc. There is also an alphabetical index of minerals and one chapter is devoted to distribution of minerals by county. For each variety the following complete information is systematically given: chemical composition, crystal form, occurrence, cleavage, fracture, color, streak, lustre, hardness, specific gravity, and a description of localities in California where it is found, including in most cases individual deposit as well as town and county.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell, Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

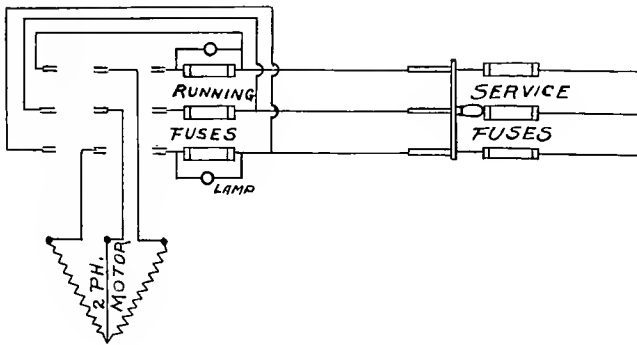
Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correlate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

A letter which fairly bristles with questions has been received, dated San Francisco, June 25th and signed E. H. The problems which it contains are as follows:

A circuit of one No. 8 and two No. 10 wires in conduit have been run from the street service to supply a 5 h.p. 2-phase, 220 volt motor. A double throw, three-pole starting switch is connected in the circuit; the switch is equipped with a spring device to prevent it from remaining closed on the starting side.



Motor Connection.

(1) Is it permissible to place fuses with rating allowed by rule No. 18 for other than rubber covered wire in the service cut-out, as the fuses at the motor protect the wires from overload?

(2) If an additional motor of 1 h.p. is installed, to what size must the service wires be increased?

(3) Sometimes an outside running fuse blows out and the motor still runs, in fact can be started with one running fuse out. How does the current find its way back to the circuit? If we connect a 220-volt lamp in parallel with each outside running fuse to indicate when fuse is blown will there be any danger from such connection?

The first question is based upon the fact that the lower limit specified for rubber covered wire in rule 18 is to prevent gradual deterioration of the high insulation by the heat of the wires and that the running fuses at the motor provide such protection; also that fuses as allowed in wires for other than rubber insulation placed in the service cut-out (one 50 amp, and two 30 amp.) would amply protect the wires from short circuit. This argument is logical and keeps continually shooting-up. The rule of the code covering this point is 23 (e) which plainly indicates that the fuses must be of the lower limit.

In answer to the second question, the adding of a 1 h.p. motor would not necessitate any increase in the size of the service wires as the present wires will transmit running current for both motors and starting current for the larger motor, while the smaller one is running. It is assumed as not probable that both motors will be started at the same time.

(3) If the motor is running and any one of the three wires is opened the motor will continue to run as a single-phase motor with a decreased efficiency.

(4) There will be no danger in connecting a lamp as described, providing it is properly connected; but the lamp will not accomplish the desired purpose as the counter current induced in the phase which may be open, bridged by the lamp, will oppose the current from the line, so that the lamp will not glow, at least not very perceptibly.

NATIONAL CONVENTION ELECTRICAL CONTRACTORS.

The annual convention of the National Electrical Contractors' Association will be held at Detroit, Mich, July 14-18. Following is a brief outline of "doings" for convention week:

Tuesday, July 14th: 9:30 a. m.—Meeting of Board of Directors and Executive Committee.

Wednesday, July 15th: Open session 10:00 a. m.

Opening of Convention—E. McCleary, Past-President National Electrical Contractors' Association.

"City of Detroit"—Commissioner John C. Gillespie.

"A Talk"—John Trix.

"Fifteen Minutes"—W. N. Matthews, Reigning Jupiter, Jovian Order.

"Workman's Compensation and Employers' Liability"—Hon. John E. Kinnane, Chairman Michigan Industrial Accident Board.

Wednesday, July 15th: 12:00 noon—Complimentary Luncheon by the Detroit Jovian League to the N. E. C. A. members and their guests, Hotel Cadillac. Robley S. Stearnes, No. 1501, New Orleans, Statesman for Louisiana, Toastmaster.

Wednesday, July 15th: 2:00 p. m.—Business Session.

Address—T. I. Jones, Commercial Section, National Electric Light Association.

Wednesday, July 15th: 7:00 p. m. Rejuvenation, Jovian Order. At the Detroit Board of Commerce Building, Lafayette Blvd. and Wayne streets.

Thursday, July 16th: 9:30 a. m.—Business Session. Hotel Cadillac.

2:00 p. m.—Business Session (Continued). Speaker—S. E. Doane, Chief Engineer, National Lamp Works of General Electric Company, "Observations of Central Stations and Contractors' Conditions in Foreign Countries."

Thursday, July 16th: 7:00 p. m.—Annual Dinner, Hotel Cadillac, L. W. Eddy, Chairman.

Friday, July 17th: N. E. C. A. Birthday.

8:30 a. m.—Automobile Ride, John H. Busby, Chairman.

1:30 p. m.—Boat Trip and Outing, Steamer "Pleasure," Foot of Bates Street. Thos. M. Templeton, Chairman.

Saturday, July 18th: Business Session if necessary.

Board of Directors' Meeting following Business Session. Executive Committee Meeting following Board of Directors' Meeting.

ELECTRICAL CONTRACTORS' NOTES.

Plans for the electric equipment for the Masonic building at Seattle, for which bids for a general contract will be opened July 15th, have been completed by H. C. Moss, engineer, White building, and plans can be secured from Saunders & Lawton, architects, White Building. The structure will cost \$125,000.

The contract for the electric wiring and equipment for the new National theatre under construction at Portland, has been awarded to the Crescent Electric Works.

Star Electric Company has obtained the contract for 35 new fire-alarm boxes for the city of Portland, Oregon. The boxes are of the positive non-interfering type. The price obtained was \$80 each.



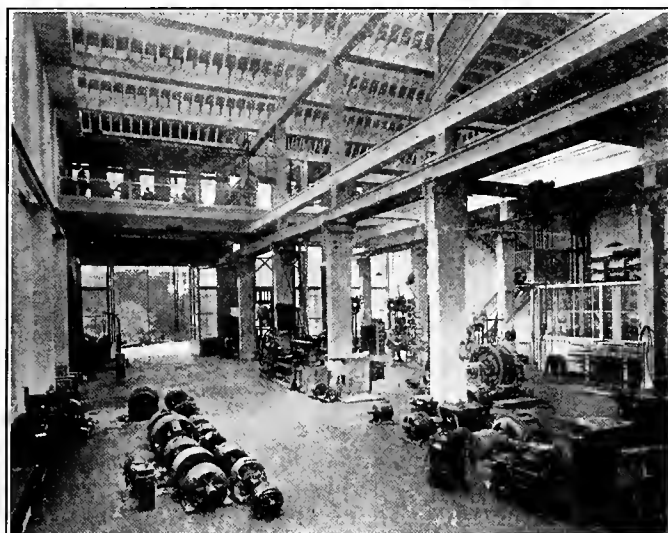
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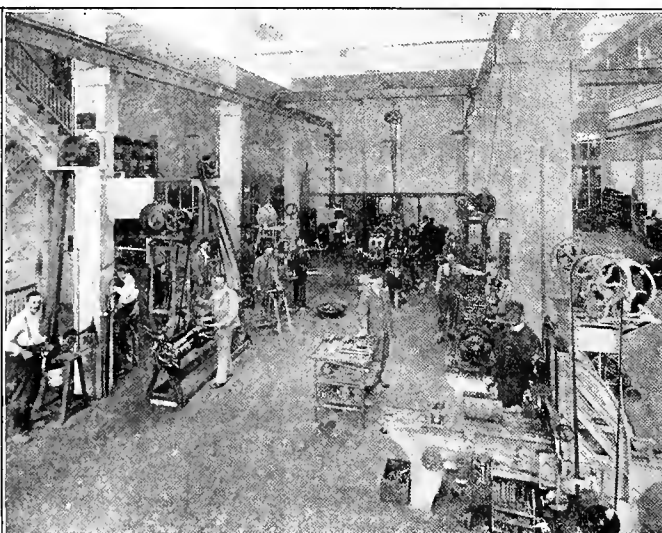
A MODERN ELECTRICAL REPAIR SHOP.

The Building.

The new shop of the Farnsworth Electrical Works, at 549-551 Mission street, San Francisco, recently built for them, presents many new features. The building has a frontage of 35 ft. on Mission street and 63 ft. on Minna street. It is specially designed for the requirements of expeditiously handling heavy machinery, such as motors, generators, transformers, hoists, etc. It is two stories high and has a 9 ft. basement. The first story is 20 ft. 6 in. in the clear, and the second story 10 ft. The height of the first story was designed to give head room for traveling cranes, two of which are used, of about 7 tons capacity each.



Machine Shop and Erecting Floor—Showing Winding Department on Mezzanine.



Individual Drive Machine Shop With Traveling Crane in Background.

Overhead Cranes.

The main crane of 23 ft. span, is designed to run from over the Minna street sidewalk to the Mission street front, thus serving the major portion of the ground floor, with one crane. This enables the loading and unloading of machinery, at the Minna street freight entrance and the placing of finished machinery on the store floor, or show windows without transfer from one bay to another.

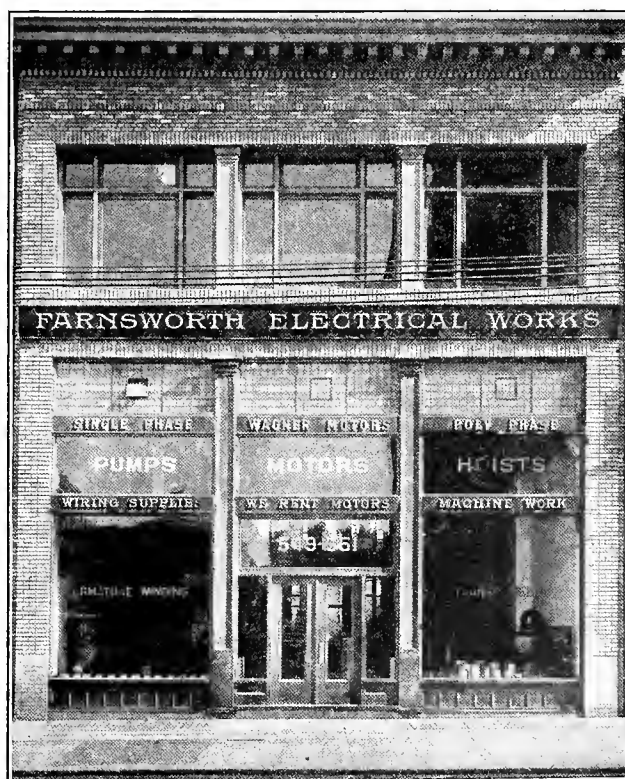
A second crane of 17 ft. span serves the machine shop bay and test department. Both of these cranes are 17 ft. above the floor, thus giving ample headroom for all purposes.

A space 35x50 ft. on the Mission street front is partitioned off for store and office purposes, the partition being so made as to allow the crane to pass through by opening a transom. This method is also used to pass the crane out of rear door over sidewalk. The sidewalk is heavily reinforced and a gutter incline built to enable the heaviest trucks to back up under crane for unloading, etc.

The first floor is used for assembling, cleaning of machinery under repairs; machine shop, tool room and test department. In the test department is a special switchboard.

The second floor is utilized for armature winding, taping, coil making, and as a store room for supplies.

The basement is used for general storage purposes, and also contains a woodworking plant, pipe threading machine, switchboard drill press, transformer vault, and shelving for patterns and forms. A pipe chute is provided on Minna street leading into basement.



Mission-Street Frontage.

Motors Used.

The machine shop equipment is all direct motor driven, individual motors being used throughout. Motor equipment used is as follows:

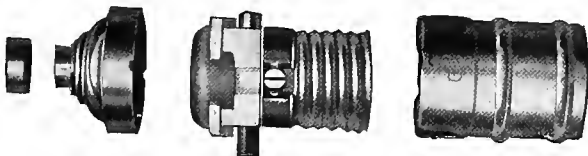
16 in. Lathe—1 h.p., 110 v., d.c., 1200 r.p.m., Arm. and field control.
 14 in. Lathe—1 h.p., 110 v., d.c., 1200 r.p.m., Arm. and field control.
 18 in. Lathe—2 h.p., 110 v., d.c., 1200 r.p.m., Arm. and field control.
 20 in. Drill—1 h.p., 110 v., d.c., 1200 r.p.m., Arm. and field control.
 Sensitive Drill— $\frac{1}{4}$ h.p., 220 v., d.c., 1500 r.p.m. No controller.
 24 in. Planer—3 h.p., 220 v., d.c., 1700 r.p.m. Field control.
 12 in. Hack Saw— $\frac{1}{4}$ h.p., 220 v., d.c. No control.
 No. 2 Mitts & Merrill Keyseater—2 $\frac{1}{2}$ h.p., 110 v., d.c., 600 r.p.m. Arm. control and field.
 6 in. Metal Saw— $\frac{1}{4}$ h.p., 220 v., d.c. No control.
 20 in. Shaper—1 h.p., 110 v., d.c., 1200 r.p.m. Arm. and field control.
 5 ft. Swing Saw—1 $\frac{1}{2}$ h.p., 220 v., 650 r.p.m., d.c. No control.
 32 in. Band Saw—2 h.p., 220 v., 1700 r.p.m., a.c., two-phase. No control.
 4 in. Pipe Machine (Line), Marble Drill (Shaft), 3 h.p., 220 v., d.c., 650 r.p.m. No control.
 12 in. Jointer—2 h.p., 110 v., 1650 r.p.m., d.c. No control.
 Air Compressor—2 h.p., 220 v., 1700 r.p.m., d.c. Pressure control.
 Emery Wheel—2 h.p., 220 v., 1700 r.p.m., d.c.
 Large Coil Winder—2 h.p., 220 v., back geared, 300 r.p.m., d.c. No control.
 Small Coil Winder— $\frac{1}{2}$ h.p., 220 v., d.c., 1400 r.p.m. Arm. control.
 Field Coil Winder— $\frac{1}{4}$ h.p., 220 v., d.c., 1600 r.p.m. Arm. control.
 Taping Machine— $\frac{1}{2}$ h.p., 220 v., d.c., 1600 r.p.m. No control.

For lighting, Mazda lamps are used. The basement is lighted with 40 watt lamps arranged in groups of 3 with switches. First floor open bays are lighted with six 500 watts lamps with Holophane Dolier steel reflectors, and under balcony 250 watt lamps with the same type reflectors are used. This size is also used in lighting the second floor. The general lighting thus obtained is entirely satisfactory, rendering portable lamps unnecessary. Switching is so arranged that any portion of the first floor or second floor can be lighted without illuminating the entire shop.

PUSH BUTTON OPERATED BRASS SHELL SOCKETS.

The extensive and satisfactory use of C-H push-button pendant switches and porcelain sockets has been the means of creating a demand for a brass shell socket having indicating push buttons instead of the rotary key and employing the high capacity switch mechanism as used in the above-mentioned switches and porcelain sockets. The rotary key flush switch has given way to the push button type and the push button socket is therefore likely to come into favor also.

The new sockets shown in the accompanying illustrations have a number of important features—indicating push-button operation; quick make-and-break switch mechanism rated at 660 watts, and 250 volts; automatic locking nozzle which eliminates the weak setscrew; cord strain relief in all pendant sockets; and the strong simple snap lock for securing the



Exploded View of No. 7500 Push-Button Brass Shell Socket.

cap to the shell. The mechanism used in these sockets is exactly the same as that used on other C-H devices rated at 750 watts and is only limited to 660 watts because there is no higher rating allowed on screw shell sockets by the underwriters. Because of the extensive use of electrical devices operated from lamp sockets this high capacity socket is particularly advantageous.

In spite of the many improvements in electrical devices, during the past 30 years, the sockets have always been secured to the fixture by means of an iron set screw and operated by a rotary key, the key being similar to that used on the gas fixture. The new C-H line of sockets has an automatic locking ring to replace the set screw and has indicating push buttons instead of the rotary key.

"Push-the-Button" is an electrical phrase—to operate the new C-H sockets—you "Push-the-Button." The operation is

very easy and natural. With pendant sockets this is especially desirable, as only one hand need be used and the lamp is not twisted or jarred. Where a husk is provided on the fixture extension buttons can be placed on the socket, which extend through small holes in the husk and allow operation.

Set Screw Replaced by Locking Ring.

The new locking ring of the C-H sockets makes it possible to attach the sockets securely on varying sizes of fixture nozzles even when a socket cover or husk is used. This is impossible where the setscrew is employed, as a screw-driver cannot be operated inside of the husk to tighten the screw.



A Convenient Push-Button Operation.



Short Electrolier Socket.



Regular Push-Button Socket

In a recent test a C-H socket was secured to one end of a pipe and another socket with the ordinary setscrew secured to the other end. Grasping one in each hand and turning counter clock-wise, the latter socket slipped, damaging the thread, then the joint where the threaded ferrule is fastened to the cap gave way and allowed the socket to slip around. The C-H socket did not loosen in this test.

Another difficulty overcome by this locking feature is the positioning of the buttons. All work during the past few years has been along the lines of providing a multiplicity of catches for snapping the cap on the shell so that the key might be located where desired. This, however, has a tendency to weaken the locking. The locking ring of C-H sockets allows the cap to be turned after it is secured, so that the location of the buttons can be taken care of, while a strong and simple snap can be used which locks the cap and shell securely together. The shell is not weakened by many slots or perforations.

All Pendant Sockets Have Cord Grip.

A cord grip in the pendant type sockets makes unnecessary the usual knots and removes all strain from the terminals. This cord grip does not require any threading through or twisting of the conductors. It is simply necessary to secure the conductor terminals to the binding screws which are placed far down on the socket and are upset. The strength of this cord grip was indicated by a test which resulted in the breaking of a No. 18 two-conductor flexible cord without any strain being transmitted to the socket terminals.

This new socket line put on the market by The Cutler-Hammer Manufacturing Company of Milwaukee consists of push-button and keyless types for fixture and pendant installation besides a short keyless socket especially suitable for small fixtures. The approval of the underwriters has been secured for the entire line.



NEWS NOTES



INCORPORATIONS.

VENICE, CAL.—Neptune Light & Power Company, \$5000, subscribed \$5, by J. O. Kaiser, L. Bukowski, F. Seeman et al.

SAN FRANCISCO, CAL.—Contra Costa Gas Company, \$250,000, shares \$100 each, subscribed \$500, by S. W. Coleman, J. E. Rodgers, A. F. Bray, W. N. Jones and C. E. Daley.

AUBURN, WASH.—Following the granting of the franchise to J. L. Veach for gas mains, the company which he represents have filed articles of incorporation, with \$50,000 capital stock under the name of the Auburn Gas Company.

ILLUMINATION.

DRAIN, ORE.—Voters have signified their approval of the construction of a municipal lighting plant.

WALLOWA, WASH.—The Enterprise Electric Company has been awarded a three year contract for a modern street lighting system.

BUCKLEY, WASH.—The Puget Sound Traction Light & Power Company has taken over the business of the Buckley Electric Company.

COLVILLE, WASH.—The Stevens County Light & Power Company, Colville, Washington, has been negotiating with the city for a municipal lighting system.

EVERETT, WASH.—The Puget Sound Traction, Light & Power Company plans an improved municipal lighting service at a material saving over the old contract.

BOISE, IDAHO.—City officials are considering the installation of a municipal lighting plant because of controversy with the Idaho-Oregon Light & Power Company.

LOS ANGELES, CAL.—A movement is on foot to extend the system of ornamental lights along Long Beach boulevard the entire distance from Los Angeles to the ocean.

LOS ANGELES, CAL.—The board of supervisors of Los Angeles county will receive bids till July 27th, for installing and maintaining an addition to the street lighting system in Laurel Canyon Lighting District.

FORT BENTON, MONT.—An election has been called for July 10th, when citizens of this city will vote on an issue of \$17,000 in bonds for the purpose of purchasing an electric light plant or the building of a new one.

BERKELEY, CAL.—The Pacific Gas & Electric Company has commenced the installation of a new distributing system for the district south of Bancroft Way and east of Shattuck avenue, which will cost about \$90,000.

DAWSON, YUKON TERRITORY.—The city authorities are planning for the public ownership of telephone, water, light and power. The city is preparing to issue bonds to the extent of \$200,000 for the purpose of installing the necessary plants.

ORANGE, CAL.—The movement for ornamental lighting posts throughout the business section of the city is again under way and takes the form of a petition from property holders asking the city board to have electric wires placed underground, the property owners to erect the ornamental poles.

ALBUQUERQUE, N. M.—The Albuquerque Gas, Light & Power Company is engaged in installing a new system of feeders which will do away with poles and wires on Central avenue. This is a part of the general improvement plans of the company, including changes in the lighting system of the city recently authorized by the city council.

REDONDO BEACH, CAL.—The board of trustees has adopted the design submitted by the Llewellyn Iron Works for ornamental lighting posts to be installed here. A 5 light system will be installed on Catalina and Pacific avenues, a 1 light system on Camino Real, a portion of Catalina ave-

nue, and on the Esplanade, and a 3 light system on Diamond street.

NEWPORT, CAL.—O'Melveny, Stephens & Milliken of Los Angeles, have declared the \$25,000 municipal bonds of Newport, for a street lighting system, invalid. The bonds were recently sold to W. K. Parkinson and Lew Wallace, president and treasurer of the board of trustees, respectively, subject to the approval of the bond firm. The contract has also been let to the F. O. Engstrom Company for the installation of a 138 post street lighting system. Proceedings will be started at once for a \$20,000 bond election.

LOS ANGELES, CAL.—As the first step toward the acquisition of a municipal lighting system, for which \$6,500,000 was voted last month, the city council, meeting with the board of public service commissioners, has decided that the Southern California Edison Company's distribution system was preferable for the city's purpose, that proceedings be immediately instituted to secure the possession, and an attempt be made to secure the electric distribution system by an amicable adjustment without recourse to litigation. A communication will be addressed to the Southern California Edison Company officials, formally asking if they will agree to sell to the city at a price fixed by the State Railroad Commission. If the company refuses to accept this proposition, condemnation proceedings will be immediately instituted.

SALT LAKE CITY, UTAH.—The Dooly Building Power Company has made application to the city commission for a franchise to furnish electricity and steam heating in Salt Lake City. The application is accompanied by a letter stating that the company intends to extend its service only throughout the immediate vicinity of its present plant. The Dooly Building Power Company was organized by the late John E. Dooly several years ago to furnish electricity and steam heating service to the Dooly building and to several other buildings in the immediate vicinity of it, in which Mr. Dooly was interested. The Dooly Estate has recently erected several large buildings in the vicinity of the original Dooly building which necessitate the enlargement of their heating and generating plant. This application is made to enable them to supply service to other customers in the vicinity in case they desire to do so.

SAN FRANCISCO, CAL.—In the electric light rate ordinance passed by the supervisors the system of charging is materially changed, but there is only a slight change in the actual cost to consumers. According to Vice-President Britton of the Pacific Gas & Electric Company, consumers will save about \$70,000 a year. Britton said he did not think the ordinance entirely fair to the company, but that no effort would be made to fight it. The new schedule calls for a graduated scale running from 7c per kw.-hr., which is charged for the first 50 kw. hours in each month, down to 3½c per kw.-hr. The present base rate of 6c is being contested in the courts. The gas rate for the ensuing year was fixed at 75c when the supervisors, after being deadlocked through four ballots, finally accepted the recommendation of the lighting and rates committee and refused to make the rate 80c, as demanded by the Pacific Gas & Electric Company. At the outset of the meeting Mr. Britton delivered his ultimatum of an 80c rate or a legal fight in the Federal courts.

SALT LAKE CITY, UTAH.—The property owners of State street met at the National City Bank on Tuesday, June 23d and organized the State Street Improvement Association with Hyrum Pingree, cashier of the National City Bank as president, Herbert S. Auerbach, of Auerbach & Company, vice-president, and Percy O. Perkins, representing the G. S. Holmes interests, as secretary. The object of this

association is to advance the business interests of State street property owners and tenants. State street has rapidly come to the front in competition with Main street as a business thoroughfare and much of this has been accomplished through the enterprise of the merchants and property owners there in installing an ornamental street lighting system and by the liberal use of light in their businesses. One of the principal purposes of forming this organization was to promote an even more elaborate system of ornamental lighting than the present one and to secure better street car service for State street. A committee was appointed to investigate the various systems of street lighting now available and to report to the association at their next meeting.

TRANSPORTATION.

POMONA, CAL.—The city council has passed an ordinance granting to the Pacific Electric Company franchise necessary for the construction of a road from Lordsburg to North Pomona to connect with the line to San Bernardino.

SEATTLE, WASH.—Seattle inaugurated its first municipal street car service on May 23, 1914. On May 30, 1914, the Lake Burien line of the city began conducting a commercial business. The first line and locally designated as division A, extends into Ballard. The second line operates in the southern part of the city.

GLOBE, ARIZ.—The State Corporation Commission has granted a permit to the Globe & Miami Traction Company to sell \$75,000 in stock and a similar amount in bonds, for the construction of an electric interurban railway service between Globe and Miami. Geo. Hill, attorney for the traction company, and Mr. De Tar will undertake the sale of stock at once.

SAN DIEGO, CAL.—The Bay Shore Railroad Company has been granted a franchise to build an electric railway from Ocean Beach across the channel of False Bay and along the Strand to Bird Rock Beach. The application for the franchise was presented by Chas. Fox as president of the road, and J. H. McKie, secretary. Work is to start within three months.

OAKLAND, CAL.—A passenger traffic agreement between the Oakland, Antioch & Eastern Railway and the Pacific Coast Steamship Company has become effective. By this agreement passengers from any point reached by the railway may purchase tickets through to any point reached by the steamship company. A similar agreement with the Pacific Navigation Company has been in effect for several months.

SACRAMENTO, CAL.—The latest official of the Northern Electric to hand in his resignation is J. B. Rowray, for many years assistant general manager and acting manager since the retirement of A. D. Schindler June 1st. W. A. McGovern, new general manager, and J. R. Wilson, general freight and passenger agent, after a trip of inspection last week, professed themselves highly pleased with the physical condition of the road.

SAN FRANCISCO, CAL.—The construction of the new car barn for the Municipal Railway on the block bounded by Seventeenth, Mariposa, York and Hampshire streets, is to be begun soon. The board of works has called for bids for excavating the site. The board received three bids for the underground electrical conductors for the railway lines, the lowest bidder being the Pacific Fire Extinguisher Co., whose offer amounted to about \$24,000.

SAN FRANCISCO, CAL.—A possible solution of the problem of building the proposed extension of the Municipal Street Railway system over Church street was suggested to the public utilities committee when it was proposed to abandon all idea of cutting a street for that district on a contour plan and simply to purchase a right of way for the street car tracks. This will only have to be about 20 feet in width. This expense was never contemplated in the bond issue, but the residents have refused to have an assessment district

formed for the supplying the street and city is now proposing to get the tracks over the hill the best way it can with the least possible expense.

SAN FRANCISCO, CAL.—Plans for the acquirement of the United Railroads by the city has been announced by Alexander Vogelsang, chairman of the public utilities of the supervisors, as follows: "There will be no bond issue. The city intends to pay for the property out of its earnings. First of all, there will be an appraisal of the physical property. This will be followed by an appraisal of the franchises. The principal franchises expire in 1929, although there are others that expire at intervals until 1952. It will be proposed to pay the company an amount equal to the sum of these two appraisals, giving a guarantee of interest at a reasonable rate. The property is then to be operated by the city, the extensions made by the city, maintenance to be cared for by the city. All of the net profits are to be devoted to extinguishing the debt due the United Railroads. A charter amendment will be necessary to put this plan into execution."

TELEPHONE AND TELEGRAPH.

GRESHAM, ORE.—The Gresham Telephone Company will build a circuit to Sandy and to Cottrell.

ELLENSBURG, WASH.—The Ellensburg Telephone Company will build a rural line to Edgemont district.

NELSON, B. C.—Appropriations have been made for a federal telephone line to be constructed across and along the east side of Kootenay landing.

BUTTE, MONT.—W. J. Tonkin has asked the county commissioners for permission to construct a telephone line between Basin Creek schoolhouse and the Five-Mile House.

CENTRALIA, WASH.—The Evergreen Telephone Company, Klickitat Telephone Company and Claquato Telephone Company have each applied to the county commissioners for a franchise to operate over the county roads.

PORTLAND, ORE.—The Home Telephone & Telegraph Company has let a contract for the erection of a new exchange for Sunnyside district at East Forty-fifth and Madison streets, to Hurley Mason Company for \$10,000.

LOPEZ, WASH.—Joseph Thornton of Lopez Island and others are forming a stock company to lay a cable of six wires from Lopez Island to Green's Point on Fidalgo Island to connect wires of Independent Telephone Company.

LOS ANGELES, CAL.—Bids will be received up to July 27th, by the board of supervisors of Los Angeles county, for the purchase of the franchise applied for, granting the right to maintain for a period of 30 years, telephone and telegraph systems in certain portions of the county.

YUCAIPA, CAL.—Work upon connecting of South Beach with a telephone system will commence at once. Lines from the townsite to three large pumping stations will be built by the Southwestern Home Telephone Company of Redlands, which controls the telephone service of the valley.

PORTLAND, ORE.—The Bell Telephone interests have asked the U. S. Government for permission to consolidate the Pacific Telephone Company and the Home Telephone Company exchanges at Spokane, and also to dispose of its \$721,000 holdings in the Northwestern Long Distance Telephone Company.

TRANSMISSION.

DEMING, N. M.—The Inspiration Copper Company has decided to issue \$4,500,000 in bonds to erect a large power plant to cost about \$1,500,000. The management will use power to run a big concentrating plant to be erected at the mines at Miami.

LOS ANGELES, CAL.—City Attorney Stephens has advised the city officials that the public service commission has full authority to handle the expenditure of \$6,500,000 power bonds money for construction work and acquirement or construction of a distributing system.

JOURNAL OF ELECTRICITY

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Devoted to the Conversion, Transmission and Distribution of Energy

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OPERATION OF MINIDOKA RECLAMATION PROJECT.

BY BARRY DIBBLE.

THE THREE TYPES OF MANAGEMENT.

BY E. ST. ELMO LEWIS.

MONTEREY GAS DECISION.

SEATTLE LIGHTING REPORT.

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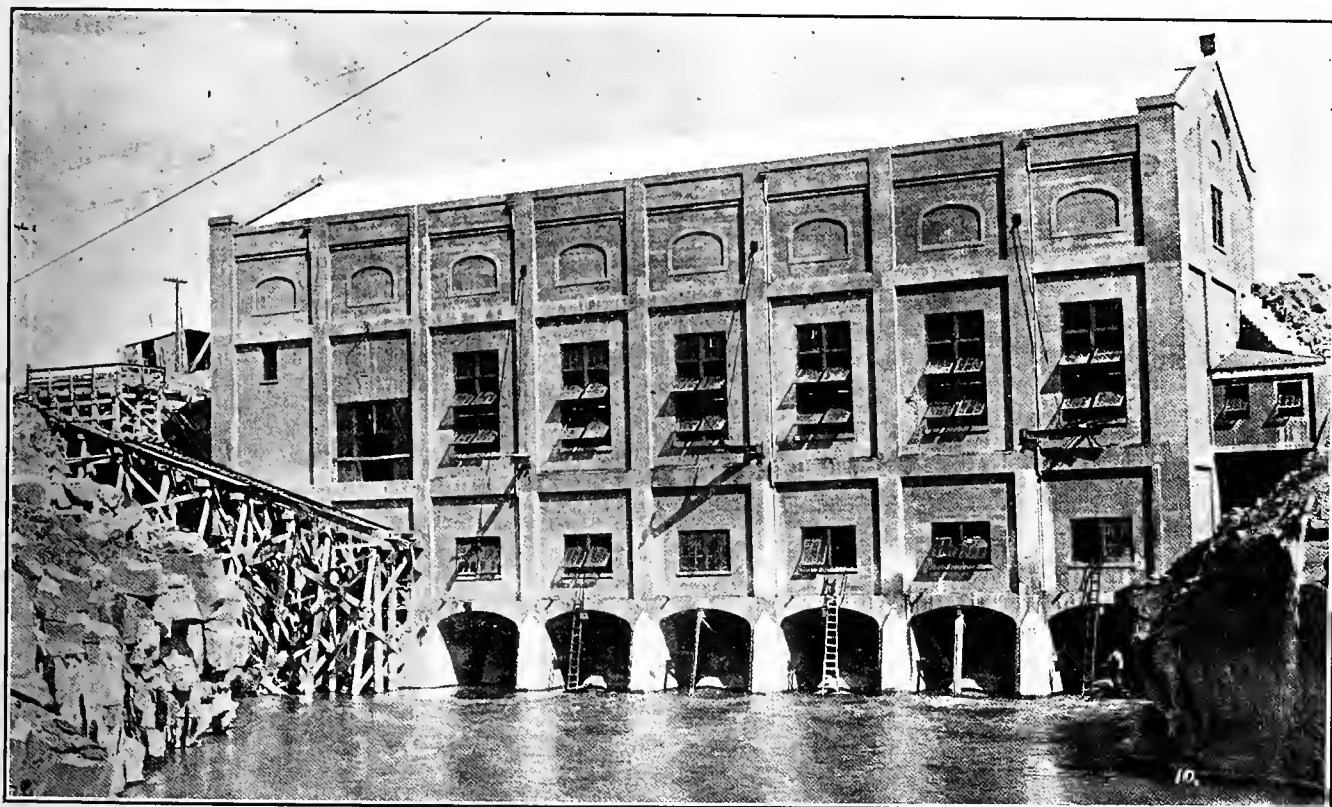
NUMBER 2

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OPERATION OF MINIDOKA RECLAMATION PROJECT

BY BARRY DIBBLE.

(After a brief description of the power development, supplementing that published in these columns June 13, 1912, the author gives the details of operating results, together with description of recent extensions. Valuable data on the use of electricity for summer pumping and winter heating are included. Mr. Barry has been in charge of construction and operation of this project for the past four years. Mr. O. H. Ensign of Los Angeles, chief mechanical and electrical engineer for the Reclamation Service, was responsible for the design of the system.—The Editor.)



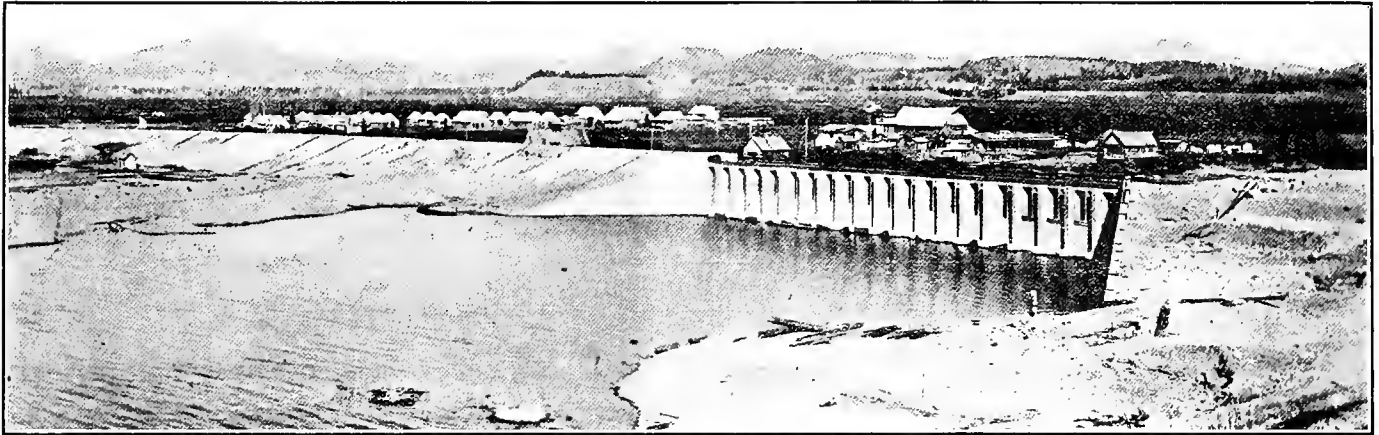
Minidoka Power House.

The Minidoka Project of the United States Reclamation Service is situated on the Snake River in Southern Idaho directly north from the north and south boundary between Utah and Nevada. It was one of the first projects begun by the Reclamation Service and is now practically completed. Water for 118,000 acres is diverted from the Snake River by a rock fill dam which has a maximum height of 86 ft. and a length of 937 ft. The spillway is a concrete structure about half a mile in length on which concrete piers have been built to hold flash-boards for storage purposes.

The drainage area above this diversion dam is 22,600 square miles. The normal flood occurs in June

and usually reaches a peak of from 30,000 to 40,000 second feet. The low water stage follows soon after the flood in July and August and sometimes the river drops to 2000 second feet, although from 2500 to 3000 second feet is the usual minimum. Prior water rights below the Minidoka Dam are entitled to the normal flow of the river up to 3400 second feet. Storage has therefore been developed in connection with the project both at Minidoka dam where 50,000 acre ft. are available and at Jackson Lake in Wyoming where a capacity of 380,000 acre feet has been obtained by a low dam.

The first unit of the project to be constructed included 70,000 acres of land lying on both sides of the



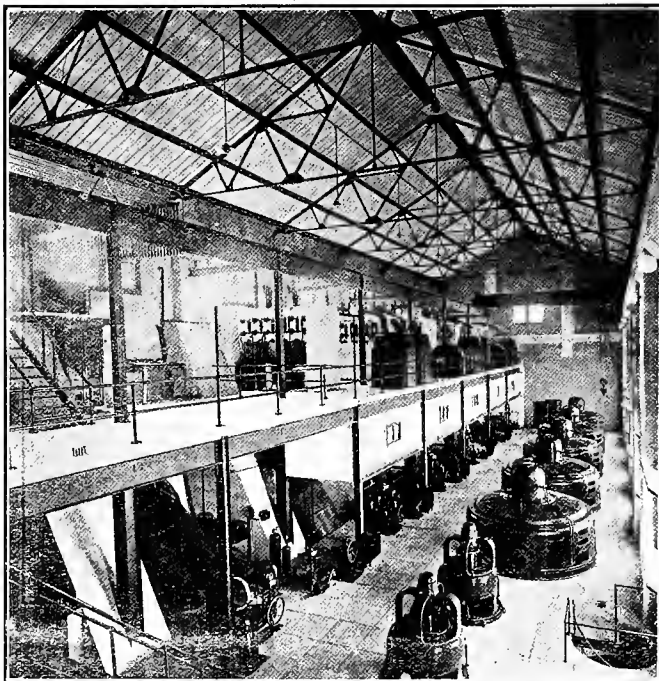
Jackson Lake Dam and Camp.

SNAKE RIVER and covered by gravity canals. In 1908, the Reclamation Service was authorized to proceed with the construction of the South Side pumping unit covering 48,000 acres of choice bench lands, some of which lay as much as 90 ft. above the gravity canal. Some water was delivered in 1909.

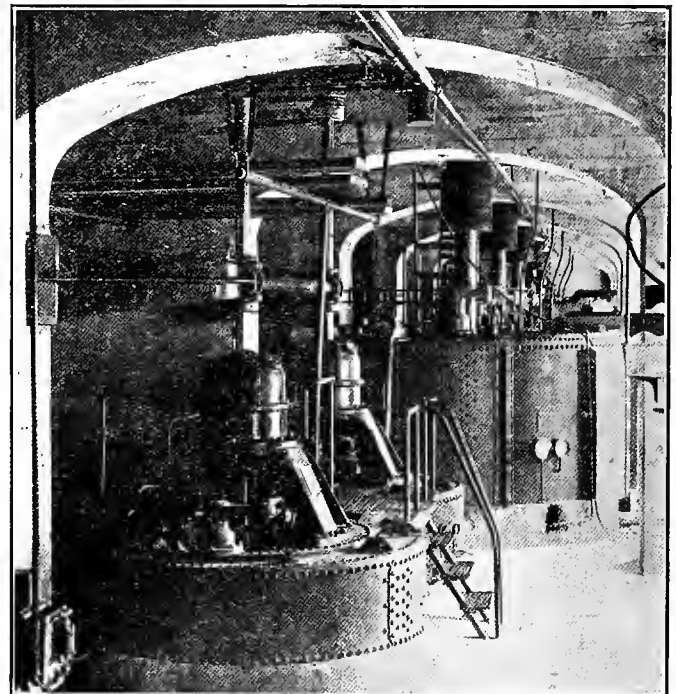
Power House.

Power is developed at Minidoka dam under a head of 46 ft.; using the water which must pass down the river for prior rights.

power plant, while the lower end of the channel is used as a tail-race. The water is taken directly from Lake Walcott, as the back water from the dam is known. Lake Walcott covers 10,000 acres and is used in the summer time as an auxiliary storage reservoir in which the water can be raised 5 ft. above the spillway crest of the dam by means of flashboards. When the lake is thus raised, additional head is made available at the power house and this is used to increase the capacity of the plant. By closely reg-



Generator Floor of Minidoka Power House.



Turbine Floor of Minidoka Power House.

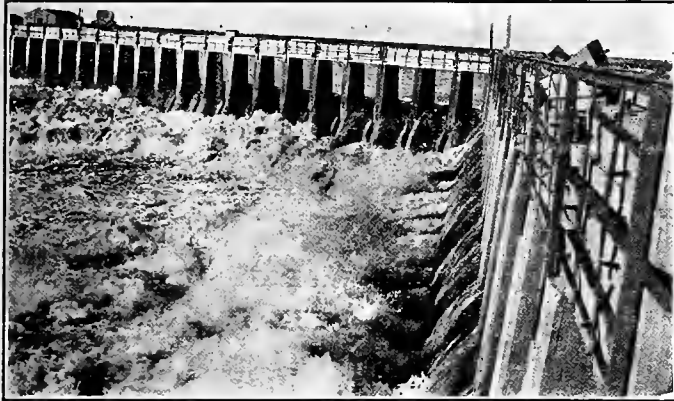
The power plant consists of five main units each having a capacity of a 2000 h.p. in the water turbines. These turbines drive electric generators which have a normal capacity of 1200 kw. each and which under a high head have delivered as much as 1600 kw. each.

The power plant is situated in the channel which was built to carry the water of the Snake River during the time that the main dam was under construction. This diversion channel is now closed by a concrete dam which is used as the up-stream wall of the

ulating the discharge of the stored water from Jackson Lake it is possible to so arrange that Lake Walcott will be at nearly its highest elevation at the time when the greatest amount of power is required for irrigation pumping. Water from the lake is taken to the turbines through 10 ft. penstocks, each of which carries approximately 500 cu. ft. per sec. when operating at full capacity.

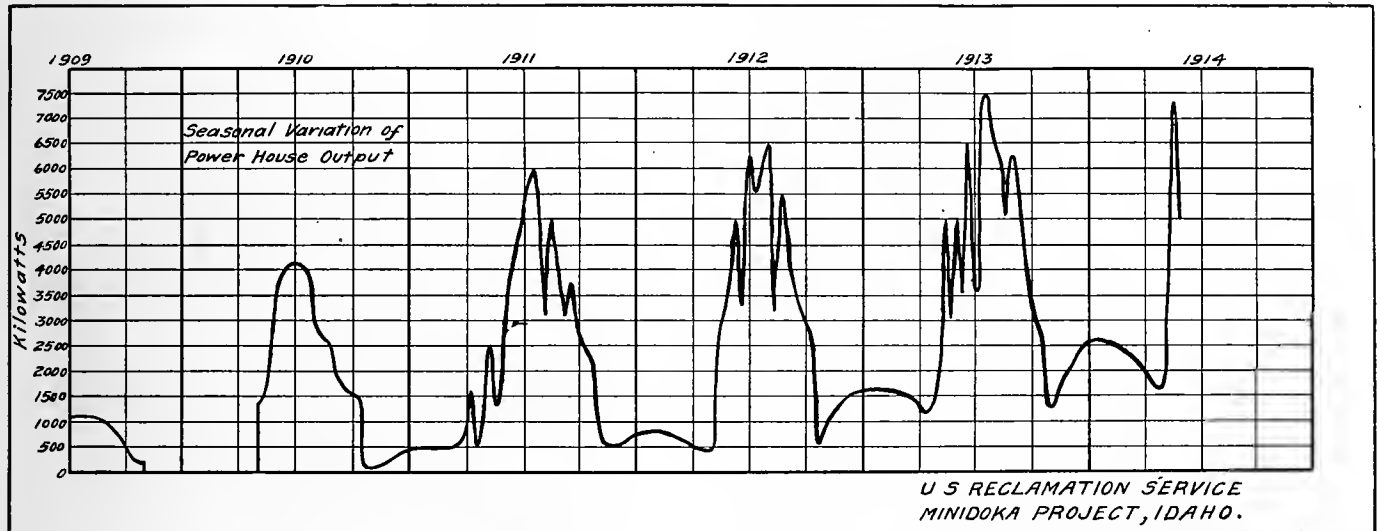
Electric energy is generated at 2300 volts and carried by cables through fiber conduit to air-cooled transformers which raise the voltage to 33,000 volts for

transmission. All the wiring and switches beyond the transformers are in duplicate and all the way through the plant precautions are taken to prevent any accident from causing serious inconvenience.



Minidoka Spillway.

The accompanying curve shows the variation of the load on the power house with the seasons. The fluctuations in load during the summer are caused by the occasional rains which lessen the irrigation demand. The normal daily load curve is practically a straight line. During 1913, the output of the station reached 25,700,000 kw.-hr. with an observed peak of 7420 kilowatts, making the annual load factor 39.9

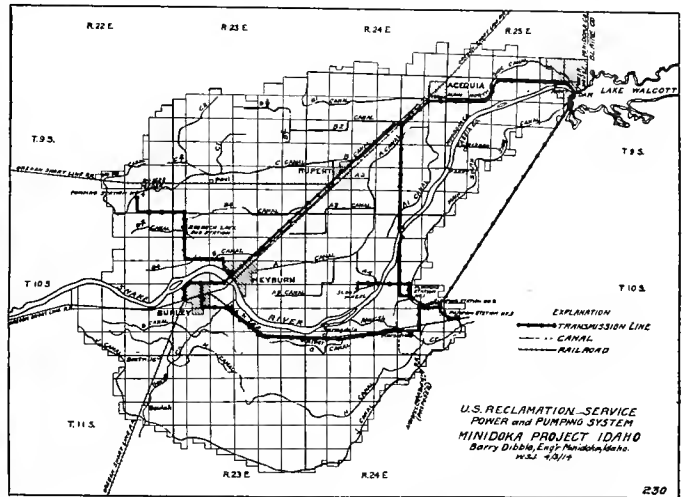


Seasonal Variation of Load on Power House.

per cent. The annual cost of operation and maintenance amounts to approximately \$16,000, or less than .07 cents per kw.-hr. independent of fixed charges.

Transmission Lines.

From the power house two transmission lines extend to the project; one going by way of Acequia, to Rupert and Heyburn, and then crossing the river to Burley, with a branch line from near Acequia which goes to No. 1 pumping station on the South Side. The other line goes directly from the power house across the river to No. 2 pumping station, a distance of about 11 miles. From there a line goes to Station No. 1 and another to Station No. 3. A new line built last winter goes from Station No. 2 to Burley and there connects with the original line from the North Side of the river. These two lines form a loop over which current



Canal and Transmission Lines of Minidoka Project.

can be supplied in either direction. From Heyburn a line extends to the West End pumping station near the west edge of the project. In all there are about 62 miles of 30,000 volt lines and over 20 miles of 2200 volt lines in the government system. These are supplemented by the distribution systems in each town and the lines owned directly by bodies of settlers. The annual cost of operating and maintaining the high tension lines is about \$40 per mile.

Pumping Stations.

The pumping stations which supply water to approximately 48,000 acres of land are the largest stations which have ever been built for irrigation purposes. In fact, it is believed that the pumping stations of the city of New Orleans, which are used in case of severe rain storms to remove the storm water from the sewers of the city, are the only pumping stations which have a larger capacity than these on the Minidoka Project. The buildings of each station are of concrete construction and contain transformers for lowering the voltage from 30,000 to 2200. The buildings also house the motors and pumps.

Altogether there are ten pumps which were originally of 125 sec. ft. capacity, each driven by a 600 h.p. motor, and two 75 sec. ft. pumps driven by 360

h.p. motors. At each station the lift is approximately 30 ft., so that the third canal is nearly 90 ft. above the gravity canal. Approximately 127,000 acre feet of

the fullest capacity. Efforts are being made, however, to arrange by rotation to spread the demand for water over a longer period without hardship to the



Pumping Station No. 1 From Forebay.

water were pumped during the season of 1913 and of this 17 per cent was used in the 30 ft. level, 36 per cent on the 60 ft. level, and 47 per cent in the 90 ft. level.

The average lift for the season was 68.3 ft. The power required was 15,900,000 kw.-hr. with a peak of 6550 kilowatts, corresponding to a load factor of 24.3 per cent. The cost for the year of operating and



Pumping Station No. 1 Discharging 500 sec. ft.

farmers and avoid the excessive demand for the very short period.

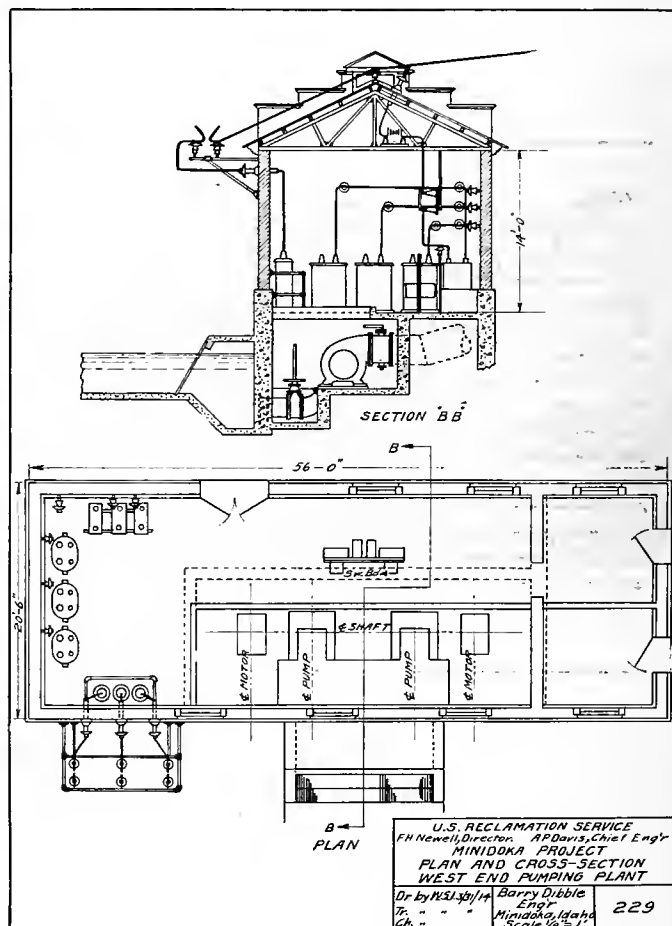
During the winter of 1913-14 alterations have been made in several of the large pumps and recent tests indicate that the changes will increase the capacity from 125 to 165 sec. ft. and improve the efficiency of these pumps from 72 per cent to over 80 per cent.



Interior of Pumping Station No. 2.

maintaining the three stations was \$13,000 exclusive of fixed charges and of the cost of power, or a trifle more than ten cents per acre foot lifted the average height. The proportion of the cost of operating and maintaining the entire power system which is chargeable against the 48,000 acres of land comprised in the South Side pumping unit averages between 50 and 55 cents per acre per year. The cost of operation and maintenance of the canal system amounts to an additional 75 cents per acre.

According to past conditions there has been a very heavy demand on the pumping stations for a week or ten days in the middle of the summer. During this time all of the machinery has been pushed to



Plan and Cross Section West End Pumping Plant.

Each of these pumping stations is operated twenty-four hours a day with three eight hour shifts with one man on each shift at each station. A foreman has general charge of all three stations.

Smaller pumping stations are located on the North Side Gravity Unit to cover small isolated high-land areas which cannot be reached economically by the canals. The West End Pumping Station is installed

to water about 2200 acres. It has a capacity of 40 sec. ft. and lifts the water about 18 ft. Two horizontal units, each driven by a 75 h.p. motor are contained in the plant. The station is designed to be as nearly automatic as a station can be built and requires attention from an operator but once a day. This is given by the ditch rider who distributes the water supplied by the pumps. Advantage was here taken of the contour of the ground to locate the pumps, and therefore the motors, below the level of the intake canal. This makes the pumps self priming and avoids the necessity for foot valves. The trifling leakage into the pump pit is drained off to adjacent low ground.

At what is known as the A-4 raise a scoop wheel is used to lift about 20 sec. ft. of water 4 ft. to irrigate some 800 acres of high-land.

Numerous drainage pumps driven by motors have been in use for some time at various points on the gravity unit to keep down the ground water level until permanent gravity drains can be completed. It will be necessary to put a permanent pumping plant for drainage purposes at what is known as Boersch Lake on the line to the West End, where drainage water flows into a pond or sump which is several feet below the normal river surface, making it impossible to drain it by gravity.



Electric Drag Line Excavator With Catapillar Traction.

Electric Drag-Line Excavators.

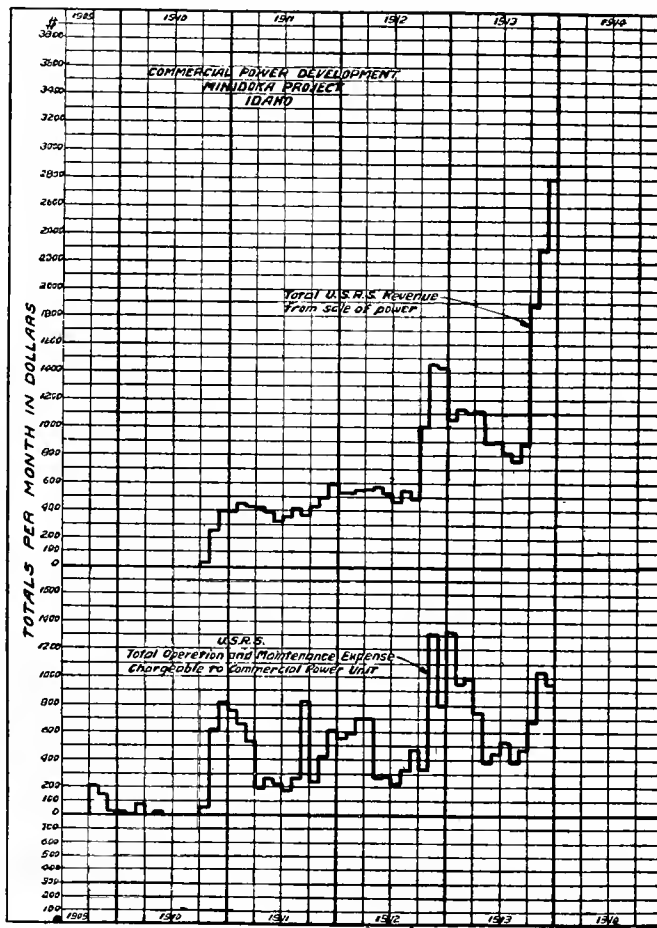
An interesting feature of the use of electricity in connection with the drainage work on the project is on the electric drag-line excavators which have been in use since September, 1913. These machines have buckets of $1\frac{1}{2}$ yds. capacity and pick up, swing and dump once every 30 or 35 seconds. They are mounted on caterpillars driven by the hoisting motors so that they move along without any other assistance, leaving in their trail deep drainage ditches and rapidly lowering ground water. They require from .35 to .50 kw. hr. per cubic yard excavated.

Commercial Development.

Early in 1910, contracts were made by the government to deliver power at 2200 volts to distributing companies in each of the principal towns of the project. Delivery of power under these contracts was begun during the month of October, 1910. So great has been the growth of business that in order to take

care of the load the equipment of the substations was doubled in 1912, and during the past season a new transmission line was built from Pumping Station No. 2 to Burley and a new substation of 1275 kw. capacity installed at Burley, while at Rupert the capacity of the substation was more than doubled again, making it of 1275 kw. capacity.

The shape of the irrigation load curve, requiring a high capacity in the summer and no load in the winter, made it desirable to offer low rates to encourage the development of the winter-load. In these small sage-brush towns, which even now have a combined population of less than 3000, it appeared highly improbable that the use of electricity in the ordinary



Commercial Power Development of Minidoka Project.

ways would ever amount to enough to warrant the operation of the power system throughout the non-irrigation season. Electric heating of the buildings and dwellings of the towns offered a new field which promised load in large blocks. In 1910, there was no commercial demand for large electric heaters and none were on the market. The government engineers undertook to study the problem of heating houses and buildings with electricity and for this purpose designed suitable heaters. The electrical manufacturing companies, however, were quick to grasp this opportunity and now there are several of them which are turning out complete lines of heaters which they ship in large quantities into this section.

During the last few years electric cooking has also made a great advance and while the rather high cost of the appliances has held back the growth of this business on the project, yet electric cooking is prov-

ing so satisfactory and convenient that more and more of the complete electric ranges are being installed. In fact, electricity is proving a great boon to the housewives and is fast becoming a necessity not only for lighting, but for cooking, heating, washing, ironing and sewing. The most elaborate installation yet attempted is that of the Rupert High School with a connected load of 435 kilowatts described in this journal April 11, 1914.

At Burley the factory of the Amalgamated Sugar Company is using over 200 kw. for power and lights in changing the beets into the best grade of white sugar. Electric power has been found particularly desirable for the centrifugals. Recently the Portland Feeder Company has installed an alfalfa mill in the vicinity of the sugar factory, where a 50 h.p. motor is used to grind the alfalfa and grain to meal at the rate of 30 tons a day and to mix it with pulp and molasses from the sugar factory for feeding some 2000 head of cattle and several thousand head of sheep. At Heyburn, a flour mill and brickyard have made use of electricity since it was first available. All of the commercial bakeries on the project are using electric ovens for their baking, with the highest degree of success. The leading restaurants also use electricity exclusively for their cooking.

Recently a number of small companies have been incorporated in the vicinity of Rupert and Heyburn to buy power from the government at wholesale rates and distribute it to the farms of the stockholders of the companies. There is almost no limit to the extent to which this development among the farmers can be carried and as time goes on it should be one of the important factors in building up the prosperity of the homesteaders. There are innumerable ways in which cheap electric power can be made to save work and money about the farms, such as pumping stock water in the winter, grinding feed, driving the grindstone and tools, milking the cows, driving the separators, churn, or bottle washer, etc., while in the home the farmer's wife is just as much entitled to the use of labor-saving devices as is her husband or her sister in town. It is not uncommon to find places where ten, fifteen or twenty dollars per month spent for power will furnish an efficient and reliable substitute for a hired hand at fifty or sixty dollars and board.

It is evident that the United States government is not the ideal form of organization to economically handle the retailing of electrical power to small consumers. Therefore the policy has been adopted of aiding the farmers to form these mutual companies which build their own lines to connect with the government system, install their own house transformers and handle the retailing of power. The government then delivers the power to these companies at some suitable point. The electrical department of the project stands at all times ready to assist the small companies to build their lines, to make their repairs, to build up their load or to aid them in any way possible. In fact, the electrical department usually takes the initiative in encouraging the farmers to find new uses for power.

These rural lines cannot yet be considered a profitable investment from a power company standpoint. However, they enhance the value of the farms which

are reached by the lines and the material saving to the farmers which comes from the use of electricity makes this investment a good one from the farmer's standpoint. The delivery of power to the farmers has only been started, but with the increased prosperity of the country it is expected that it will show a very healthy growth. Considering the fact that in the past eight years the present towns and farms have all grown from a sagebrush desert, the following outline of the commercial load connected to the government system on January 1, 1914, forms an interesting comment on the progress which has already been made in these communities.

Commercial Power Load.

Items.	Apparatus Connected December 31, 1913.	Units.	Kw.
60 Watt Lamps or equivalents.....	5,745	344.7	
Flat Irons	236	118.4	
All Night Arcs.....	5	3.	
Heating (consumers)	291	1,573.1	
Toasters	15	8.4	
Hot Plates	11	16.1	
Vacuum Cleaners	10	1.5	
Ranges	24	83.04	
Bake Ovens	3	33.2	
Water Heaters	13	22.2	
Small Motors	21	11.3	
Picture Machines	5	15.	
Coffee Urns	4	7.4	
"X" Rays	1	3.	
Rectifiers	1	1.1	
Motors (1 h.p. and over)	47	618.62	
Total Dec. 31, 1913		2,860.13	
Total Dec. 31, 1912		1,691.37	
Per cent increase for year 1913.....		78.5	
No. of consumers connected Dec. 31, 1913.....		686	
No. of consumers connected Dec. 31, 1912.....		492	
Per cent increase for year 1913.....		39.4	

The following rates are made for electrical power on all new contracts. The schedule has been so arranged that it applies to all customers, large and small, wholesale and retail. The discounts are frankly based on the estimated difference in the cost of service. The rates are designed to encourage a good load factor and an extended use of power.

Abstract of Standard Rate Schedule. Light, Power and Appliance Rates.

Apply to energy used for all purposes unless special provision is made to take advantage of lower rates for heating rooms and buildings.

\$2.00 per month per kw. for 50 hours use of maximum demand.
 .03 per kw.-hr. from 50 to 100 hr. use of maximum demand.
 .02 per kw.-hr. from 100 to 150 hr. use of maximum demand.
 .01 per kw.-hr. from 150 to 300 hr. use of maximum demand.
 .005 per kw.-hr. over 300 hr. use of maximum demand.
 25 per cent additional during June, July and August.
 Maximum demand based on 15 minute peak.
 ½ kilowatt is smallest quantity contracted.
 Quantity discounts varying from 2 per cent for a 2 kw. load to 30 per cent for 100 kw. and over.
 10 per cent discount if energy is delivered and metered at 2200 volts.

Special Heating Rates.

Apply only from September 1 to June 1 to power that is separately metered and used solely for heating rooms and buildings.

\$1.25 per kw. per month at 220 volts.
 .75 per kw. per month at 2200 volts.
 Each heating device connected must be paid for for a minimum period of four consecutive months.
 Or as an alternative a demand meter may be installed to show the greatest load used each month. In this case the maximum for the season must be paid at least four months.

The light, power and appliance schedule it will be noted is based on the load factor principle and avoids the necessity for separate meters for power used for different purposes. It has been found very satisfactory in building up desirable load and in encouraging the small consumers to add to their current consuming devices without materially increasing the transformer capacity needed.

At the present time the permanent investment in the Minidoka power system is as follows:

Power plant and accessories.....	\$ 475,000
Office, shop and storehouse building.....	9,000
South side pumping station.....	490,000
Pumping station, gravity unit.....	21,000
Transmission lines	73,000
Substations	42,000
Total	\$1,110,000

SELLING ELECTRIC SERVICE

"THE THREE TYPES OF MANAGEMENT."

BY E. ST. ELMO LEWIS.

(This is the last of a series of three articles on Management by Mr. Lewis, who is President Detroit Executive's Club and advertising manager Burroughs Adding Machine Company. The first article in this series appeared in this Journal for May 30, the second on June 20, 1914.—The Editors.)

The Efficient Management.

The efficient manager has one object constantly before him—the elimination of waste. He realizes that every bit of material in his place can be used at 100 per cent efficiency or less; that every bit of energy that he pays for can be used at 100 per cent efficiency or less; and that time can be used in the same way.

He knows that things do not happen, that there is a cause for every effect.

He knows also that men can be taught, for he is teaching them. He knows that stenographers in an office can be taught accuracy, speed, English, or how to write a letter. He takes from his department manager the time wasting job of acting as primary school teacher to his stenographers.

He knows that foremen should simply supervise, they should not be expected to teach men the best ways of doing work. He knows that men vary in capacity, but he knows also that men learn to do better work at twenty-five than they did when they started as apprentices; that the best men have a certain way of doing things that can be taught to others, are therefore a plant can be taught how to increase production. It is a question of analysis, planning and executing. Therefore he goes at the proposition of raising efficiencies in a definite, concrete, tangible way, something like this:

1. He makes time studies of the work.
2. He places these studies in the hands of trained thinkers and scientific men who plan the work and fit the schedules.
3. He establishes the idea of functional foremanship.
4. He makes improvements in shop methods necessary to get the greatest possible product from the worker.
5. He puts a wage system at work that will place a premium upon a man who exercises the greatest efficiency. A big problem? Of course it is, but it must be solved as nearly as may be, must it not? Its bigness does not effect its pressing call for a solution.

The efficient manager, after analysis, adopts a plan starting with the Taylor System, or the Emerson System, or any one of many which all come under the general term of scientific management. He starts from somewhere to go somewhere in his management. Suppose he decides to start with the Emerson System. He tests his present management against the twelve Principles of Efficiency as Mr. Emerson calls them:

- | | |
|-----------------------------------|------------------------------------|
| 1.—Definite Plans and Ideals. | 8.—Determination of Standards. |
| 2.—Supernal Common Sense. | 9.—Standard Practice Instructions. |
| 3.—Discipline. | 10.—Standardized Conditions. |
| 4.—Competent Guidance. | 11.—Standardizing Operations. |
| 5.—The Fair Deal. | 12.—Efficiency Reward. |
| 6.—Despatching. | |
| 7.—Reliable and Adequate Records. | |

While this is not a treatise on efficiency but on cost keeping efficiency, intended to show how to eliminate the waste of time, work, thought, material (all of which spell m-o-n-e-y in business) in the handling of costs, yet it is necessary to explain the philosophy of efficiency if we are to handle costs efficiently.

No manager can escape the necessity for knowing the value of what he does when it comes to costs any more than he can of any other part of his work.

"Increase the net," is the cry.

This manager realizes that all work in a factory, in an office, goes by dependent sequence. No man's work stands alone.

The other day a manufacturer was asked what he thought his efficiency was in different departments. He said that "He thought that his efficiency was 75 per cent at least," and he forgot the law of dependent sequence. If the raw stock department was 75 per cent efficient, and the department to which it first went 95 per cent efficient and the next two were each 75 per cent efficient at the end of the fourth operation, the end result would be only 40.1 per cent efficient. If each of the four departments were 80 per cent efficient, the end result would be 41 per cent efficient.

If one department were 75 per cent efficient and another department were 125 per cent efficient, the end efficiency would only be 93.75 per cent efficient. The efficient manager, therefore asks of the cost department such records as will assist in the establishment of a complete record of the efficiency and of how it has cost to gain the amount of efficiency that has been attained.

Values must be established as well as costs, and for this purpose we must have every order that goes through a plant, every function of department standardized, establishing the best as a standard of value, by which to judge our efficiency.

Out of that will come the best—

1. Rate of pay for each man or woman.
2. Number of people to be employed in doing a particular work.
3. Kind of men for each kind of work.
4. Standard time for the operation. These standards should be indicated on the same records by which the system tells the actual things that were done in the work. In other words, it should show standards as well as performance on each record.

If the comptroller is necessary to show where money goes, then the efficiency manager is necessary to show what is obtained for the money. The cost accountant should be concerned principally with arranging his systems of cost-keeping so that reliable, immediate, and adequate records may be kept of the value of the commodities received for the money invested.

The same record should show:

- (a) The comptroller or auditor where the money goes.
- (b) The manager where standards of value have been realized, and where losses are occurring in time, labor and material.

In the past the cost accountant has too frequently been merely a man of figures, having little or no conception of what the figures really meant. He was essentially a bookkeeper who didn't know the significance of the things he was handling, and he was only concerned with totals, averages, percentages. So long as he secured his balance, he was satisfied with his results. He knew of no standards for comparing with values and failed to realize that balance sheets should be used as efficiency charts. Balance sheets can be veritable mines of misinformation. Paper profits have mislead many a manager.

A plant can be made to show fine profits on the balance sheets for a time. Efficiency charts would show up the starvation at a glance.

Before the cost accountant can become efficient, the management must become efficient. If the management is not efficient, the cost work will not be organized, functionalized, so that it can reflect truly, adequately and completely the real value of the business performance. Therefore, the cost accounting has to reflect what is actually being done. No matter how efficient the cost accountant may be, he cannot make an inefficient plant, or an inefficient organization, efficient. He can reflect only what an organization is doing, showing blanks for those kinds of records which the management handling the business does not permit him to make.

On the other hand, no matter how efficient may be the plan or organization, no matter how efficient may be the individual member of the organization, if the cost accounting records are not efficiency records, there will never be any adequate information placed before the comptroller, or the general manager, that will give them an opportunity to accurately gauge, in the first place, what has been received for the money, and in the second place, where inefficiencies may be eradicated.

The manager under any efficient plan of organization must realize that wastes, principally those which he does not now see, are the most vital concern of management. The "doer" type of American manager wants volume of production, volume of sales, volume of this and volume of that. He doesn't realize that efficiency is concerned with the net. That is the final as well as the primal test of his efficiency, of his real worth to the organization.

An engineer of national prominence said the other day, "It is absolutely bewildering to note how managers will permit continuous, relatively large wastes to continue rather than incur a pay roll expense that will stop it." Let such men understand that waste is the largest "fixed charge" in most factories.

The efficient manager will therefore develop his cost system along the line of obtaining efficiencies as against standards set up by those who are most familiar with what machines and skilled men can produce when all these highest efficiency of production.

He knows a cost system to be a means to an end, and not an end in itself.

He knows that knowing costs is but the beginning of knowledge, and that unless he has some ideal standards with which to compare his costs he is still running the business with but half the information necessary to realize its greatest possible success.

What is the real difference between the rule-of-thumb manager and the systematic manager?

The former guesses at what happened and the latter knows what happened. Neither necessarily knows what the value of the happening really is—the latter knows what it cost, the former can't be sure, but he can pay his bills—sometimes.

The difference between the systematic manager and the efficient manager is fundamental. The former occupies his time in writing history. He is thinking of yesterday; he is always at least one day behind the work; generally he is from a week to a month behind.

The efficient manager is writing prophecies. He is scientifically determining what is going to happen the day after tomorrow. He is systematic too, but his system is projected into the future. He does not care what happened last week. He is never later than today. He was preparing for today six months ago.

Step into a great business—get behind the scenes a moment, peer into the laboratories. There are unique furnaces for steel making, there are schools for man training, there are machines that will not be placed on the market for five years—there are careful analysis of markets to be developed two years from now.

The researches are being made—men with note books and open ears and eyes are traveling—engineers are experimenting—all preparing for tomorrow.

When the day comes these managers go ahead methodically developing their day-before-yesterday plans, and the game of doing business pays for the prophetic vision. As battles are not fought under the inspiration of the moment, "so the efficient manager never waits for the fighting. He always forces it."

That is the difference between the various types of managers—the difference between their business—the difference between their cost systems. It appears in the net!

A kite wire telephone solved the difficulty of keeping up the wires when a flood in the Salinas River district, California, recently washed away pole after pole. The telephone company's men carried a bridle wire across the river by means of a number of large box kites and then used this strand as a messenger for drawing the telephone wires across. Talking was carried on successfully over this kite line until the recession of the water permitted the laying of a permanent cable.

Electric welding by the resistance process is accomplished by passing an electric current of large amperage at low voltage across the junction of the pieces to be welded. From 2000 to 50,000 amperes at from 1 to 7 volts are used in welding from $\frac{1}{4}$ in. to 3 in. round or equivalent section. The heat is generated in the metal because of its resistance, which increases as the heat increases, the greatest amperage being necessary at the beginning of the heat effect. Usually no flux is required. The process is more applicable to new work than to repairs. W. A. Hedges presents a paper in the June, 1914, Journal of the American Society of Engineers which more fully tells of the advantages of electric welding and its application.

ELECTRICAL DEMONSTRATIONS.

BY E. L. ARNOLD AND D. B. MUNROE.

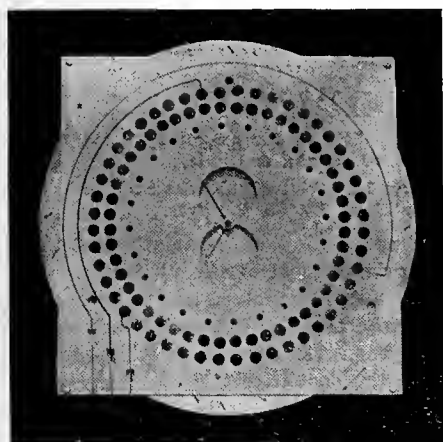
(These demonstrations for class room work were presented as a thesis to the University of Southern California for the degree of Bachelor of Science in Electrical Engineering, and delivered as a paper at the last meeting of the Los Angeles Section, A. I. E. E., by the authors.—The Editor.)

Proposition III—Induction Motor.

The object of this demonstration is to show simultaneously the different actions that are occurring in the induction motor. A four pole three-phase induction motor was chosen as the basis of the demonstration; having 48 inductors in the stator winding, and of the squirrel cage rotor type.

The model was constructed so that for the different desired positions the direction of current in the various coils of each phase can be readily determined as well as the relative strength of this current; also for these same positions the position of the four rotating poles with respect to the stator windings and the strength of the magnetic field under each group of coils in each phase.

This was accomplished by having a stationary part on which was represented the windings of the stator, and colored in the three different colors, red, black, green, one color for each phase. Each inductor of the stator was represented by two circles painted in the color corresponding to that particular phase and grouped in combination of four inductors.



Model of Induction Motor.

Connections were led in from one corner to the three different phases represented by their respective circles and connected to the different phases at an angle of 120 degrees. Where these connections appear on the stationary plate, three holes, one in each representative line wire, were cut and under which the revolving element appeared. In this manner by means of arrows the direction of current whether flowing in on a certain phase or out could be readily seen.

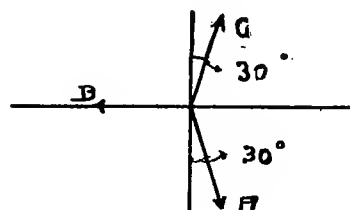
Another opening was placed in the middle of the band of inductors where the connecting wire was tapped in and on the rotating members. Placed so they would appear under this opening, were either a cross or a dot used to indicate the direction of the current in the coils.

A series of holes were bored in front of these coils through which the position of the field could be found and its rotation made evident when the moving ele-

ment was rotated. A certain position of the moving part was chosen to enable the position of the poles to be determined after which they rotated in unison with the change of current in the phases.

In order to do this readily a position was taken so that there was no current in one of the phases, for example phase B.

Then current in phase A is flowing out and in C it is flowing in and both currents are of the same strength.



Representative Diagram.

By construction of a representative diagram and superimposing the vector of the magnetizing flux in stator iron for a given position the north pole was found to lie directly in front of the "feeding in" band of the stator inductors that were carrying no current or, in other words, in front of the B phase.

Having determined the position of one of the poles the other three were at right angles to it and each other and were so laid out. This gives the strongest point of the field and so it was colored deep at this point and shaded off to zero and another color used for the south pole which began at this zero and reached a maximum at 90 degrees away from the original north pole. This enables one to see the field where it is the strongest and where it gradually reaches zero and builds up in the opposite direction. Near the center two large circles were cut in the stationary part, with their centers on the same line, and each circumference passing through the center of the fixed member.

Three vectors were drawn from the center at 120 degrees apart and in the colors and order of the three phases previously mentioned. The length of these vectors from the center to where they passed under these large circles is proportional to the strength of the current at that instant in the phase that is of the same color as the vector considered.

The method of obtaining the above arrows on the rotating member was by putting the stationary part in place and rotating the member the desired amount and the conditions for that position ascertained. And so on until the entire 360 degrees had been covered.

The traction resistance of a 28-ton electric car has been found by the University of Illinois to be $R = 4 + 0.222S + 0.00582S^2$ when R is resistance in pounds per ton and S the speed in miles per hour. More definite account of air resistance is given by the formula

$R = 4 + 0.222S + 0.00181 \frac{A}{W} S^2$ when A is the cross-sectional area of the car in square feet and W is the car weight in tons. These formulae are the equations of a parabola which closely approximates the curve of actual observations. They apply to speeds between 5 and 45 miles per hour.

MONTEREY GAS DECISION.

Case No. 499—California Railroad Commission.

Regarding the claim of the City of Monterey, California, that the rates charged by the Coast Valleys Gas & Electric Company are unjust and unreasonable, Commissioner John M. Eshleman, under date of June 30, 1914, finds that the rates are unjust and unreasonable and orders a rate of \$1.30 per M. cu. ft. for the first 5000 cu. ft. per month per meter, and of \$1.00 for all over that amount. As his accompanying opinion enunciates important matters of commission policy the major portion is here reproduced in full. After a brief review of the financial history of the company and its predecessors, he continues:

None of the books of the various predecessor companies were offered in evidence nor was any testimony introduced which would indicate either the book value or original cost of the properties or any portion thereof acquired by the defendant in this case, nor whether or not sinking funds for the redemption of the several issues of underlying bonds had been set up by these predecessor companies prior to the actual transfer in each case and no material evidence is in the record tending to establish what the fair or market value of the stocks and bonds of any of the predecessor companies was originally or at any subsequent time. In view of the above statement it will be evident that the mere fact that so much stock and so many bonds were issued by this defendant or even that so much money was expended is of little assistance in attempting to determine a fair value to be placed on a particular portion of the properties so acquired for the purpose of this case.

Defendant presented at the hearing inventory, valuation and rate reports prepared by Ford, Bacon & Davis, engineers, covering all the existing properties of the Coast Valleys Gas & Electric Company as of August 31, 1912, with additions and betterments to December 31, 1913. A summary of these reports, in so far as the gas plant and system at Monterey and Pacific Grove are involved, together with a summary of the valuation report prepared by Mr. A. R. Kelley of the commission's engineering department, is given in Table I.

It will be noted that the overhead charges estimated by Ford, Bacon & Davis amount to something over 40.8 per cent of the sum of unit costs placed by them on the physical property and that in addition to the overhead allowances shown, intangible items, including "Rights, Capital and Organization and Going Concern," etc., are included which brings the total overhead and intangible values claimed to over 90 per cent of the estimated bare physical cost. Not only does the defendant ask that all of these intangible items be allowed in fixing a rate to be charged by it for gas in the city of Monterey, but the commission is also asked to allow 10 per cent return on the full estimated reproduction cost, including all the overhead and intangible items, large appreciation in real estate values, the estimated cost of paving over mains and services, which expense was never incurred by this defendant or any of its predecessors, and, in addition, a largely increased depreciation annuity to amortize an amount said to represent the accrued deficit in depreciation reserve, from the original organization of the predecessor companies to the present time. The accrued depreciation in the gas plant and system at Monterey and Pacific Grove on August 31, 1912, as shown in a report prepared by Ford, Bacon & Davis is estimated to be \$43,980.61

It is interesting to note the manner in which a strict reproduction, new theory is utterly disregarded by the engineers employed by the company at times and again adhered to tenaciously when that theory will best serve to justify the various estimates and claims of defendant. In increasing the depreciation annuity to compensate past alleged deficits, the engineers have entirely abandoned the reproduction new

Table I.

Estimated Cost to Reproduce New.
Ford, Bacon
& Davis. A. R. Kelley

Real estate prorated to general structures	\$ 1,250.00	\$ 1,250.00
Real estate prorated to gas plant.....	6,666.66	6,666.66
Office buildings and general structures (prorated)	1,750.00	1,750.00
Gas plant buildings and structures....	8,217.00	(a) 8,706.50
Holders	2,289.00	2,200.00
Furnaces, boilers and accessories.....	5,513.25	5,513.25
Gas generators	2,383.00	2,383.00
Purification apparatus	3,991.90	3,961.00
Accessory equipment at works.....	1,329.65	1,221.95
Boosting and regulating apparatus....	4,469.23	4,469.23
High pressure mains.....	4,537.02	(b) 3,695.37
Low pressure mains.....	42,255.84	25,878.81
Gas services.....	10,331.58	6,885.72
Paving	26,352.22	.....
Service regulators.....	2,017.81	1,899.25
Gas meters	7,211.36	6,091.90
General office equipment, etc. (prorated)	882.92	882.92
Stable and miscellaneous equipment (prorated)	431.10	431.10
Total tangible capital less overhead expense	\$131,879.54	\$83,886.66
1—Contingencies, incomplete inventory, etc.	11,037.44	6,300.05
2—Contractors' profit	12,155.14	.....
3—Engineering and supervision.....	10,937.72	.....
4—Interest and taxes during construction	17,431.05	.....
5—Injuries and damage.....	2,340.00	.....
6—Rights, capital and organization and going concern	65,800.00	.....
7—Engineering, supervision, organization, legal expenses and taxes during construction .....	.....	9,018.68
8—Interest during construction.....	.....	2,976.15
Total overhead and intangible.....	\$119,701.35	\$18,294.88
Total estimated reproduction cost.....	251,580.89	102,181.54
Materials and supplies.....	1,584.00	1,584.00
Additions and betterments:		
Gas generators	5,003.00	5,003.00
Purification apparatus.....	2,080.00	2,080.00
Low pressure mains.....	2,110.00	2,110.00
Gas services	746.00	746.00
Total additions and betterments.....	\$ 9,939.00	\$ 9,939.00
Total to December 31, 1913.....	263,103.89	113,704.54

(a) Including \$489.50 for an oil tank listed with electrical equipment by Ford, Bacon & Davis.

(b) Including 3 district regulators at \$125 each, not included in this item by Ford, Bacon & Davis.

theory and adopted the historic method which attempts to arrive at the original cost of the plant as it now exists.

Mr. Kelley submitted an estimate of the cost to reproduce the property new and there appears a wide difference in opinion between Mr. Kelley and the engineers for the company as to the cost of certain portions of the plant. In so far as the gas plant and buildings are concerned, the unit costs used by Mr. Kelley and the company's engineers compare very closely and in several, if not the majority, of the items Mr. Kelley has accepted and used those appearing in the Ford, Bacon & Davis appraisal. The present value placed on the real estate prorated to the gas plant at Monterey, however, being one-third of \$20,000, appears from the evidence to be excessive and I am of the opinion that \$15,000 would be a very liberal allowance for the whole tract at this time, or \$5,000 to be prorated to the gas plant on the company's basis of segregation. The original cost of this property, comprising the entire block with the exception of one lot, was not made clear but was probably not less than \$2500 or more than \$5000.

Paving over mains and services, amounting to \$26,352.22, not including overhead, has been included in the Ford, Bacon & Davis report and very properly omitted by Mr. Kelley. This commission has heretofore on several occasions indicated its position in regard to this item where it represents no actual expenditure made by the present or a previous owner of a property, and I do not deem it necessary at this time to discuss at length the reasons for not allowing the item in cases such as the present one.

The different unit costs used by the Ford, Bacon & Davis engineers and Mr. Kelley for street mains and services, ac-

count largely for the great difference between the two total reproduction costs arrived at, and I am of the opinion that those used by Mr. Kelley are at least liberal for the class and character of the work contemplated in his report. Mr. F. C. Millard, appearing for defendant, testified concerning the value of the gas plant and system supplying Monterey and Pacific Grove, and while the hasty manner in which his investigation of the properties was carried on rendered his report of little value to the commission in determining the issues of this case, it recalled one point worthy of attention, namely, that some of the street mains were "Converse" pipe and not the standard black pipe used exclusively in the more recent installations. I will allow \$800 over and above the costs found by Mr. Kelley for the difference in price on pipe as noted. The labor costs used by Mr. Kelley, while much lower than those used by the company's engineers, appear from records of actual construction in Monterey and Pacific Grove to be ample even before the addition of overhead charges.

The cost of installing gas meters was a point on which Mr. Kelley differed greatly from the engineers appearing for the company, who maintained that \$2.00 was a reasonable amount to be allowed for this item. Mr. Kelley contended that 50c was ample although he used 75c in arriving at the cost of meters installed. To my mind there can be no question but that the cost used by the company's engineers is excessive and that the figure used by Mr. Kelley will in all probability exceed, without the addition of overhead, the actual cost to the company.

Both Mr. Kelley and the engineers for the company have, through error, included electrical instruments estimated to cost \$78.75, and this item should be deducted from both estimates after being increased for the overhead allowed in each case.

The question of overhead expense was discussed at length by engineers for the company and Mr. Kelley, and, as usual, there appeared a great difference of opinion as to the proper percentages to use in the case of each item and in the aggregate. A comparison of the percentages used is shown in the following table:

Table II.—Percentages of Overhead Expenses.		Buildings, etc..	Real Estate....	Gas Plant Equipment..	Services	Street Mains...	Meters	Tools and Misc.
Ford, Bacon & Davis:								
Contingencies	0	10	10*	10	10	10	5	5
Contractors' profit.....	0	10	15	15	15	0	0	0
Engineering and supervision	0	7½	7½	7½	7½	7½	0	0
Interest and taxes.....	10½	10½	10½	10½	10½	10½	10½	10½
Apparent total.....	10½	38	43	43	43	23	15½	
Actual cumulative total	10½	43.7*	50*	50*	50*	24.7*	16*	
Kelley:								
Contingencies	0	10	10*	10	10	5	0	0
Engineering, supervision, organization, legal expenses and taxes	10	10	10	10	10	10	10	10
Interest	3	3	3	3	3	3	3	3
Apparent total.....	13	23	23	23	23	18	18	
Actual cumulative total	13 1/3	24.6*	24.6*	24.6*	24.6*	19	19	

*No contingencies on boilers and 5 per cent on boosting and regulating apparatus.

I have hereinbefore referred to the fact that the general effect of the overhead percentages used by Ford, Bacon & Davis is to increase the estimated bare costs of all the gas properties in Monterey and Pacific Grove, including real estate, over 40.8 per cent, while those used by Mr. Kelley will increase the estimated costs, less overhead, over 21.8 per cent. While on the whole Mr. Kelley's overhead percentages, with the exception of that for contingencies, may be considered as being at least fair under the circumstances of this particular case, including as it does the item of "organization," it is my opinion, in view of the unit costs used, that the allow-

ance for contingencies is entirely too high. A percentage not to exceed 5 per cent of the estimated bare physical costs, less real estate, meters, general office equipment, tools and miscellaneous, would have been amply liberal and would, in all probability, considerably exceed the actual original cost. Mr. Kelley has allowed about 13 1/3 per cent overhead on a greatly appreciated value of the real estate owned by the company and while such an allowance may, in some measure, be justified on a strict reproduction theory, I do not believe it should be allowed as an element of value in this case.

Intangible values claimed by the defendant company, in so far as the gas properties in Monterey and Pacific Grove are concerned, are estimated by the engineers for the company at \$65,800 under the terms "Rights, Capital and Organization" and "Going Value." Using the same ratio as shown in the report prepared by Ford, Bacon & Davis for the purpose of segregating the item "Other Than Physical Property \$65,800.00" into its principal component parts, it is found that the values claimed are:

Rights, capital and organization.....	\$36,370.69
Going value	\$29,429.31

Organization expense has been provided for by Mr. Kelley in his overhead allowance.

The item "Capital" is presumably working capital, and can be amply provided for by allowing two months' operating expense at \$3,586.00 on the basis of the company's statement for the year 1913, in addition to "Materials and Supplies" \$1584, as reported. If interest for one-half of one year is allowed on construction, I can see no reason for allowing any working capital for that purpose other than materials and supplies ordinarily kept on hand.

There remains then the item of "Rights," which may be assumed to cover the cost of franchises. The evidence does not disclose what was paid for any franchise under which this company operates. Quite probably little or nothing was expended for such purpose.

The question of what constituted "Going Value" is largely a matter of opinion and the only evidence aside from the highly theoretical assumption by the engineers for the defendant appears to be that no depreciation reserve has been set up to provide for the ultimate replacement of each element of physical property at the end of its useful life.

On a strict reproduction theory it is difficult to understand how the question of past deficits can be considered or why, if such deficits actually occurred and if, contrary to the usual practice with small companies such as the predecessors of defendant, they were not occasioned by the investment of surplus earnings in plant, the present owners should be re-imbursed for losses borne by former owners of the property. At any event, it is not clear to me how early losses can add to the present value of this or any other plant. The whole trouble in this and many other cases before the commission, is that engineers representing utilities will not be consistent. Because a property has lost money certainly does not make it more valuable, although it of course makes it more costly, and the only theory upon which losses could be considered at all in rate fixing is on the theory that cost should be the basis upon which rates should be determined; and the justification for the cost basis for fixing rates is found in the fact that when any one incurs an expense for another, he has a right to expect to be reimbursed. In short, considerations of equity are the only ones that should appeal to a governmental agency in endeavoring to determine a basis upon which an earning shall be allowed. This commission should always be ready to give consideration to every equitable claim of a utility, whether it could be forced to do so under a strict interpretation of the law or not. And on the other hand, it certainly is a peculiar attitude to be assumed by any one who desires to give or receive fair treatment, to say that considerations of equity must be controlling upon this commission in fixing rates when such equity is in favor of the

utility, but that no account should be taken nor consideration given to equity when such a procedure would tend in anywise to decrease the amount upon which an earning is desired to be made.

It should be understood by utilities and the public alike and recognized by commissions and courts that when you take away from an enterprise the right to determine for whom and for what price it will conduct its business, you have eliminated the possibility of applying the same rules of value as obtain in an unregulated enterprise. Value, as commercially understood is something which cannot be determined until after the earning power is determined and the fact upon which commissions are asked to find, when asked to find value as commercially understood, is a fact which finally has no existence until after the authority of the state has been exercised in determining the proper conditions upon which the business shall be conducted, the proper rates, and so the earning power. The sooner it is understood by the utilities that under modern conditions they are literally at the mercy of the state, the sooner they will realize that only equitable considerations are the ones that will finally have weight, and until commissions and courts representing the sovereignty of the state realize that always they should make the "ought" determine the "must" such governmental agencies have not become equal to their task. I do not mean to suggest that any agency should be subject to the caprice of governmental authority, but I do insist that it should be recognized as a plain fact by the utilities that they are subject to regulation and that the character of such regulation and its extent will be largely determined by the attitude of the utilities themselves.

It is inconceivable to me how any engineer or how any utility could expect public officials of any intelligence whatsoever to accept exaggerated so-called "values" such as the one here presented, wherein every principle of consistency is violated and every known method of loading resorted to in order to increase the amount upon which an earning shall be expected. If as widely divergent results can be reached by competent engineers dealing with the same subject matter, as have here been reached, then the most that can be said is that the value of engineering aid to rate fixing is much over-estimated, or that one or the other engineer, where such widely different results are obtained, is mentally dishonest. I do not mean by this a reflection upon Mr. Woodbridge, the engineer who made the physical appraisal in this case, but my reflection is upon the method and those responsible for it. What the commission would like to know is the sum of money upon which it ought to allow an earning in any case, and it will serve no good purpose and will be merely a waste of time for utilities to present an exaggerated statement with the hope that this commission may follow a practice, too prevalent in the past, of splitting the difference between such estimate and some other which is perhaps lower. This commission, however, should have no desire whatsoever in the matter, either that the basis for rate fixing be large or small. It should merely desire the facts, and when theories must be applied to facts, only those theories which give to the utility and the patrons what ought to be accorded should be followed.

The profit of $2\frac{1}{2}$ per cent which defendant asks, introduces another intangible which if capitalized at 8 per cent would amount to something in excess of \$82,000 and this brings out rather forcibly the fact that any return, on an investment in or value of a property, over and above the "cost of money" is an allowance which to some extent at least provides for those necessary expenditures incidental to the construction of a plant and the creation of a going concern which would not appear in any subsequent appraisal of the physical properties. The natural or apparent hazard of the business is usually reflected in the cost of money itself which fact is at once made apparent by a comparison between that cost where a material hazard may be assumed to exist as in the

present case where it is said to be $6\frac{1}{2}$ per cent and the cost in cases of minimum hazard as with government bonds. The hazard, actual or assumed, incidental to the creation and transaction of any business, from the investor's point of view, and which view eventually regulates the price or cost of money, may be the relative security of earning power as compared with some other investment or may depend primarily upon the relative security of the principal. In any event the immediate effect of the element of hazard is apparent in the cost of money. The security of earning power is largely safeguarded by the measure of protection from competition which the state, through this commission, can give. The security of the principal is obviously dependent at any time upon the relation which is maintained between value of the properties and the total amount of the securities issued thereupon.

Engineers for defendant contend that the company should be allowed a return of 10 per cent on the "invested capital" over and above operating expenses (including ordinary maintenance) and an allowance for depreciation. This 10 per cent is made up by figuring the average cost of money at $6\frac{1}{2}$ per cent and adding to this percentage $2\frac{1}{2}$ per cent for "profit" and 1 per cent for "obsolescence of equipment." The term "invested capital," as used by the engineers, appears, in so far as the physical plant is concerned, to have no reference to original investment as no evidence was introduced bearing on that subject, but in estimating the proper amount to be hereafter allowed for depreciation the original investment theory has evidently been adopted. Notwithstanding the fact that defendant admits that it has in its possession the books and records of the predecessor companies since about the time the gas plant and system was constructed, the company's engineers and officials chose to estimate "invested capital" on the basis of what a duplicate plant would cost new, including greatly appreciated land values and alleged intangible values, amounting, as I have hereinbefore mentioned, to \$65,800 or almost 50 per cent of the full estimated cost to reproduce the physical plant. To my mind it is wholly illogical, after ignoring actual historical costs to attempt to arrive at invested capital upon a hypothetical basis not only in regard to the unit costs themselves but in the actual process by which the property was created. Having once discarded the original cost or investment basis, and having laid claim to all appreciated values, it would appear that the only alternative left would be to estimate present value upon the depreciated reproduction theory unless we are to depend entirely upon the amount of stocks and bonds outstanding, which latter basis would be obviously unfair under the circumstances of this particular case.

The ratio between the estimated cost to reproduce new the gas properties of defendant in Monterey and Pacific Grove, exclusive of real estate, and the depreciated reproduction cost or so-called "present value" of those properties, as shown in the valuation report prepared for the defendant company by Ford, Bacon & Davis, is 75.16 per cent as of August 31, 1912. Upon the same theory, assuming that this ratio of 75.16 per cent is correct and that it remained the same on December 31, 1913, the present depreciated value of the property, as of that date, upon the basis of Mr. Kelley's estimate of the cost to reproduce the plant new corrected to allow for the tangible and intangible additions already referred to and disregarding for the moment the corresponding deductions, would be \$96,237.97.

The opinion concludes with an analysis and criticism of the detailed operating expenses and revenue from gas sales during 1913, together with a recommendation that a station meter be installed at the Monterey plant and suitable facilities be provided for determining the quality of gas, the accuracy of customers' meters and the distribution pressure.

SEATTLE LIGHTING REPORT.

Superintendent J. D. Ross has compiled a comprehensive biennial report of the lighting department of the City of Seattle, Wash., for the years 1912 and 1913. A condensed history and description of the system is given to supplement the extended one published two years ago, and much space is devoted to the developments of the past two years. A valuable feature is the schedule of costs of construction work and the synopsis of work done on electric cooking and heating.

The financial statement shows assets of \$4,773,932.62, bonded indebtedness of \$3,240,000, accounts payable and interest due of \$304,375.22, depreciation and sinking funds \$59,599.92, capital investment \$359,857.26 and surplus revenues for 1908-1913 absorbed by extensions, new construction, etc., \$810,100.21.

Revenues totalled \$910,477.35 of which \$245,089.99 was derived from sale of current for municipal service and \$659,673.08 from current sales for business, residence and power. Operating expenses for 26,306,861 kw.-hrs. delivered were \$437,140.03, additions and improvements totalled \$868,488.75 and revenue surplus after providing for operation, maintenance, reconstruction, interest, lost accounts and depreciation was \$274,657.68.

Over 29,000 customers are being served at a 6-cent rate with 50-cent monthly minimum bill.

Most of the expenditures for additions and improvements were on the new concrete dam, which will be completed to a height of 180 ft. this year, and on the city substations.

Electrical Heating.

During the past two years several experiments have been carried on by the lighting department to determine the practicability of using electricity for heating the home. For this purpose several houses have been fitted up by their owners with electric heaters, both of the direct radiation type and the type used in connection with hot water radiators. The lighting department connected these houses to its mains, made a special rate for current and kept complete records of the temperatures maintained in the house and the amount of current used.

The first house equipped is of concrete construction with solid $8\frac{1}{2}$ in. walls, and contains five rooms, having a total floor area of 418 sq. ft., a cubic capacity of 3252 cu. ft., an outside wall area of 491 sq. ft., and a window area of 127 sq. ft. In this house were installed five electric heaters of the direct radiation type, of which three were 2 kw. and the other two had a capacity of $1\frac{1}{2}$ and 0.6 kw. respectively. Recording meters were placed in the service to measure the current; and the daily maximum, average and minimum temperatures, both outside and inside the house, were observed and recorded. The total consumption for the year amounted to 10,250 kw.hours, running from 2430 kw. hours in December to 20 kw. hours in July. An average temperature of 70 degrees was maintained inside the house, and the minimum at night was kept above 58 degrees. The mean outside temperature was 51 degrees and the minimum, 26 degrees.

In this house no discrimination was made with regard to the time of day when the current was used. Another method of using electric heat is to install an

electric hot water heater to replace, or to be used in conjunction with, the regulation boiler on a hot water heating system. In theory this method is less efficient than when direct radiating heaters are used, on account of a slight loss in the piping of the hot water system. An advantage which more than offsets this slight loss is that a hot water storage tank may be installed which will supply heat to the house for several hours after the current is turned off, and in this way the supply of current may be cut off during the hours of maximum demand on the lighting plant for current for lighting purposes. With this scheme of electric heating, enough customers can be supplied with current for heating purposes to exhaust the full capacity of the present distribution system without any further installation whatever except for the mere service wires from the pole to the house, since the heaters will be cut off during the hours when light is used. There are now four houses equipped with the hot water system of electric heating on the city's lines. Experience shows that 1 kw. of heater capacity will supply 20 sq. ft. of radiation and will require 20 gallons of storage tank capacity to supply heat during the lighting peak in winter. The cost of making the installation, which is borne by the customer, will run from \$10 to \$25 per kilowatt capacity of the heater, depending on the size and layout of the house. This expense includes merely the wiring and installation of the electric heater and the cost of the heater itself. The records show that in one house of frame construction having 200 ft. of radiation supplying four rooms with outside wall area of 846 sq. ft. and window area of 201 sq. ft. and cubic contents of 7290 cu. ft., the monthly consumption of current during the winter months averages 3000 kw. hours, with a temperature maintained in the house at 68 to 70 degrees, and the average monthly consumption for the entire year will to about 13,000 kw. hours.

To sum up the results of all the heating experiments to date: Electrical heating for homes is perfectly feasible and is the most convenient and cleanest method. Despite the fact that heaters of 100 per cent efficiency are used, the amount of current needed makes the expense at present rates several times that for heating with coal. One pound of coal contains as much heat as three kw. hours in electricity, and with coal at \$6 per ton and current at 2c per kw. hour, the coal costs 0.3c as against 6c for the current, a ratio of 20 to 1 in favor of the coal. This is partially offset by the fact that all of the heat of the current is utilized, while from 30 to 80 per cent of the heat of the coal is wasted. Compared on a basis of cost, electricity at one-half cent per kw. hour is from 25 per cent to 40 per cent higher than coal at \$6 per ton. By developing water power in large units and supplying heating during "off-peak" hours, it will probably be possible in the future to supply current at rates that will make its use for heating within the reach of the average income.

While electric heating must be regarded as a luxury at the present rates, this is not true of electric cooking. Scores of people in Seattle depend upon electricity altogether for cooking and uniformly agree that it is the most convenient, safest and cleanest method and no more expensive than any other method. The lighting department is encouraging the use of

electric current for cooking and has made a rate of 3c per kw. hour for this class of service. The engineering staff of the department has collected data on electric cooking and heating and is ready to assist customers who wish to use current for this purpose. An average of all the bills rendered during the past two years shows that the average monthly bill for current for electric cooking is \$3.03.

ANTIOCH RATE CASE.

In a decision covering seventy-seven pages and embracing the results of many months of work on the part of the Railroad Commission and the engineers of the Pacific Gas and Electric Company, the Railroad Commission of California has established rates which the Pacific Gas and Electric Company may charge in the town of Antioch, and at the same time has established a cost basis for the production of electric energy, which will make it a comparatively easy matter to fix rates in any city or community where this company operates.

The decision segregates rate-making into two distinct divisions, based on the cost of production and the cost of distribution. As determined by the Commission, the cost of generating electricity with the Pacific Gas and Electric Company's system and delivering it to the limits of any city is 7.312 mills per kilowatt hour. With this figure as a basis, the Commission has only to determine the cost of distribution in any community in order to establish rates for that community. In Antioch a graduated scale, ranging from 7 cents to 3 cents per kilowatt hour, is established.

The decision grew out of a comparatively unimportant rate inquiry. Rates to be charged in Antioch were under consideration, and the Commission seized the opportunity for making a thorough investigation of the entire generating and transmission system of the company.

The company contended that it was entitled to a return on the basis of the cost to reproduce its plant new, plus an allowance for going concern value. In the main, the decision agrees with this contention, but declares that it will hold good only when the corporation's plant has been kept up to 100 per cent efficiency, and a proper depreciation fund has been established.

The constant 7.312 mills per kilowatt hour is arrived at by taking the reproduction value of the company's generating and transmission plants in 1911, when they were definitely known, adding the value of permanent improvements since then and writing off depreciation. With this figure known, the Commission allows the company 8 per cent interest, although the company itself asked for 8½, allowing for maintenance and depreciation and allows the operating cost.

How Rate Was Fixed.

With the total of energy to be generated closely estimated, the cost per kilowatt is obtained by simple division. The figures from which the 7.312 miles was obtained are:

Value of hydroelectric plants	\$14,675,174.26
Value of steam-electric plants	5,455,282.16
Value of transmission system	5,930,529.10
Total	\$26,060,985.52

Annual Operation, 1914.

Interest at 8 per cent, depreciation and maintenance.....	\$ 2,408,377.66
Operating cost	1,171,978.90
Power purchased	824,200.00
Total	\$ 4,404,556.56

It is estimated that the company will produce 602,360,837 kilowatts of energy. To meet the cost of generating it and transmitting it to cities for distribution, its rate is thus placed at 7.312 mills.

As to the claim as a "going concern," the Commission contented itself with repeating the well-known decision of Judge Van Fleet, to the effect that rates must be fixed on a basis of money wisely and honestly expended. "The best evidence of what should be allowed for developing the business, is the amount of money which has actually been expended for that business."

"The effects of abnormal conditions, bad management, poor judgment, the lack of ordinary care and foresight must be borne by the utility and not by the public.

"It would be far wiser for the utilities of the State, instead of trying to establish a depreciation fund, to deal with the Commission with absolute frankness, and after assisting the Commission to ascertain the fact, to ask frankly for the margin in the rate of return which will enable them to earn a profit in excess of the actual necessary expenses.

"The rate of return should be such a rate as is high enough to secure funds for the development of the business, and in reaching its conclusions on this point the Commission should be liberal in its attitude."

Rates Fixed for Antioch.

Following its newly formed policy, the Commission fixed rates for Antioch as follows:

First 20 kilowatt-hours, per month.....	7c per kw.-hr.
Next 980 kilowatt-hours, per month.....	4c per kw.-hr.
Over 1000 kilowatt-hours, per month.....	3c per kw.-hr.

The top rate for lighting is cut from 8 cents. The new rate will save the town about \$570 a year for street lighting, in addition to the saving to private citizens.

Timber preservation by chemical treatment made notable progress during 1913, according to a report recently issued by the American Wood Preservers' Association in co-operation with the forest service of the department of agriculture. The report states that 93 wood preserving plants in 1913 consumed over 108 million gallons of creosote oil, 26 million pounds of dry zinc chloride, and nearly 4 million gallons of other liquid preservatives. With these the plants treated over 153 million cu. ft. of timber, or about 23 per cent more than in 1912. The output from additional plants unrecorded would increase the totals given. In Great Britain and most of the European countries practically every wooden cross-tie and telephone or telegraph pole receives preservative treatment. In the United States less than 30 per cent of the 135 million cross-ties annually consumed are treated, and the proper treatment of an annual consumption of 4 million poles may be said to have scarcely commenced.

UTAH COMPANY LOSES GOVERNMENT SUIT.

The Utah Light & Railway Company is enjoined in a decree handed down by Judge John A. Marshall in the United States District Court, from occupying government land with portions of its hydroelectric power works, pipe line, diverting dam and power house in Big Cottonwood canyon. The decree was based on a decision of the circuit court of appeals in a similar case, that of the United States against the Utah Power & Light Company, reported in 209 Fed. 554. The bill of complaint in the present case was filed in the United States District Court in Salt Lake City by Attorney General Geo. B. Wickersham, through Hiram E. Booth, then United States District Attorney, September 23, 1912, in which the defendant company was charged with operating its electric power plant upon government lands without first having secured a permit from the secretary of the interior for the operation of the plant. This is a companion case to U. S. vs. Utah Power & Light Company, the decision of which by the circuit court of appeals is reported in 209 Fed. 554. The defendant claims here, as was contended in that case, that its right to its reservoir and canals vested under section 2339 of the revised statutes of the United States, and that subsequent legislation does not affect it.

The decree, as handed down by Judge Marshall is in full as follows:

In the case cited, it was determined that the act of May 14, 1896 (29 St. 120) superseded section 2339 with respect to such rights over public lands for electric power purposes, the beneficial use to which the defendant devotes its water appropriation; that after the passage of that act no right of way could be obtained except pursuant to a permit from the Secretary of the Interior. It is admitted that the defendant has not obtained such a permit, and the question to be determined, therefore, is whether the defendant's right had vested prior to May 14, 1896. These rights were initiated by two notices of appropriation, the one on May 13, 1893, and the other on June 5, 1894, but the reservoir and canals were not completed and water was not in fact diverted until after May 14, 1896. There is a concurrence of authority that the right to an easement for a ditch or canal over the public land, claimed under section 2339, only vests on the completion of the work, but that when so completed, as between rival claimants, the title will relate back to the commencement of the work, or notice of appropriation, provided the work was prosecuted with due diligence. This rule of relation, however, has no application against the United States. As to it, prior to the final completion, the appropriator is acting under a revocable license, and cannot complain if the license be withdrawn, even if, as in the instant case, he has expended a large amount of money in expectation of finally obtaining title.

U. S. v. Rickey Land & Cattle Company, 164 Fed. 496; it would then seem that when the decision of the circuit court of appeals is applied to this case a decree for the plaintiff must follow.

It may, with force be argued that a statute must be construed as intended to operate prospectively and not retrospectively, if such construction does not clearly violate its language, and that the statute of May 14, 1896, should be held to apply only to future permits; and that those who have already commenced work pursuant to the implied license of section 2339, so far as appropriations of water for electric power purposes are concerned; there seems to be no injustice in substituting for an undefined implied license a defined express license, and the act can be properly construed prospectively as providing in effect that no title to an easement should thereafter vest. The object of

the act, as determined by the court of appeals, was to substitute the permit system for the vested easement system, if an exception of inchoate rights had been intended it would doubtless have been expressed.

It is suggested as the Secretary of the Interior did not promulgate regulations under the act of May 14, 1896, until after the diversion of the water was completed that the defendant's rights are saved. I do not think so. The question, is, what was the intent of Congress in enacting the statute of May 14, 1896? The subsequent acts of the Secretary of the Interior can cast no light on this intent. If the intent was to terminate the system of vested easements over the public lands for canals for power purposes, and to authorize the Secretary of the Interior to issue revocable permits thereafter, then no delay by the secretary in issuing a permit can confer vested rights.

The injunction sought by the plaintiff will issue with respect to that part of the defendant's works which are situated on the lands of the United States.

The decree is dated Salt Lake City, Utah, June 29, 1914.

ELECTRICAL IRRIGATION IN UTAH.

For the purpose of determining the feasibility of irrigated land in the vicinity of Willard by electrically operated pumps from deep wells, the Utah Power & Light Company have recently installed a demonstration well on the farm of A. A. Lemon at North Willard. A fairly good flow of water was struck at 46 ft. depth and a hand pump demonstrated that the well had considerable capacity. An electrically operated pump was later installed and a flow of 75 gallons per minute was obtained without in any way reducing the appreciable supply of the well. The power company believes that a considerable acreage in the vicinity of Willard which does not now have a water right from the gravity ditches will be reclaimed by the installation of electrically operated pumps.

At Brigham City many valuable peach orchards were grown and are now cultivated by means of water obtained from electrically pumped wells. The municipal electric plant at Brigham City has established a low rate for power believing that the municipality would profit more from the highly productive orchards thus created than by charging a prohibitive rate for power which would prevent its use.

The Utah Power & Light Company has purchased the power plant formerly owned by the Ogden Rapid Transit interests at Brigham City and this plant is now idle owing to a considerable surplus of power. It is expected however that if the Utah Power & Light Company can develop a sufficient market for its power for irrigation purposes in this vicinity, that it will resume the operation of the power plant.

Large pumping plants have already been installed on the shores of the Utah Lake to supply the bench lands and also to maintain the normal flow of the Jordan River throughout the summer, thus providing a constant supply for the irrigation canals in Salt Lake Valley.

The pumping idea has found further application in the Cache Valley in northern Utah and in certain southern Idaho districts, where valuable lands have hitherto failed to reach their utmost productiveness because of the cost of erecting the dams and other works that are necessary in irrigation by gravity, or because of a shortage of water in the late summer. The Utah Power & Light Company has been active in the establishment of small pumping plants.

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Fact, law and judgment are the tripod upon which valuation is supported. When the property to be valued is a public utility designed, built and operated by engineers it is necessary to look to the engineers for fact, to the courts for law and the commissions for judgment. Anything which creates the least suspicion concerning the integrity of any one of these factors should be carefully investigated. Consequently the opinion of the Railroad Commission of California regarding the complaint of the City of Monterey that the gas rates of the Coast Valleys Gas & Electric Company were unjust is worthy of careful study.

The opinion of Commissioner J. M. Eshleman, as printed elsewhere in these columns, gives evidence to show that neither the stock and bond issues nor past expenditures were of assistance in arriving at a proper valuation. The estimate of the commission's engineer as to the cost to reproduce the plant new was less than half that of the firm employed by the company, especially as regards intangible values. The commissioner finds several inconsistencies in the methods of estimating and wide divergencies in results. These inconsistencies he characterizes as "mental dishonesty" and these divergencies as proof that "the value of engineering aid to rate-fixing is much over-estimated."

While it is neither the purpose nor the province of this journal to defend the valuation methods employed, and while one such opinion does not make law nor even represent good judgment, attention should be called to certain facts with which lawyers are not familiar.

There is no profession which must adhere to facts more closely than engineering. Fact and truth are inseparable. As the poet says, "Facts are the stones heaped about the mouth of the well in whose depth truth reflects the sky." Engineering ethics are insistent that expert engineering opinion cannot be colored to favor the case of any client.

Valuation of public utility undertakings for rate-fixing purposes is a matter of such recent origin that its rules and methods have not yet been standardized in theory or practice. Great difference of opinion exists as to what should be included. Some precedent exists for every item which does not agree with the opinion of the commissioner, and an equally authoritative contradiction can be found for many of his own views. Finality can be given to many of these controversies only by court rulings. Even the rulings of the lower courts are contradictory and can be taken merely as indicative of the general theory which valuations must follow in order to make them valid.

Because engineers are rarely able to predetermine the cost of construction, with all the possible contingencies which may arise, is no reason why they should cease their endeavors. It is not humanly possible to construct a plant by the substitution of hind-

sight for foresight. And because one engineer's appraisal of past work coincides no more nearly with another's than does one estimate of future work match another is no reason why one or the other should be accused of dishonesty, mental or otherwise.

Inconsistency and dishonesty are not synonyms. The law is a maze of contradictions, all judgment is fallible, and the blame attaches as much to the courts and the commissions as to the engineers for any inconsistency which may have roused the righteous wrath of the commission.

Anger is sometimes a most valuable thing, especially as the finest expression of a personality in action. But it may also be an evidence of a lack of self control.

Most public utilities fully understand "that under modern conditions they are literally at the mercy of the state" and are doing everything in their power to be worthy of that mercy. Under modern conditions, also, the quality of mercy is strained through the individual official representing the state control. Such officials should realize that meticulous supervision permitting a minimum return on capital invested can counteract any stabilizing influence which can be given the securities. These dangers can be avoided by a broad-minded policy fostering the needs of the utilities as well as the public.

Business can be graphically represented as a vector diagram of forces. The equilibrium triangle of

business energy is made up of the passive forces of nature, the active forces of men and the resultant force of capital. The principles

Types of Management

of engineering, the art of directing forces, are now being applied to the scientific management of business.

Some of these principles have been outlined in the series of articles on "The Three Types of Management," which has recently been published in these columns. But considering successful management as essentially a form of human engineering which directs the forces of nature, labor and money to most effectively gain profits, it is possible to classify several other types in the science of management. These several groups are often only different names for the same methods, having been developed to meet the peculiar requirements of each kind of business.

Mr. Lewis considers management from the standpoint of the accountant who is liable to treat business as a study of forms rather than of forces, static instead of kinetic. He shows how the strenuous manager of the old school did his work by rule-of-thumb and cut-and-try; he tells how the systematic manager fell into a rut in finding out what had already happened, and he compares both with the efficient manager who has adopted the good features and rejected the bad from the older methods. However, even an efficient manager is not effective unless his efforts are properly directed. The efficiency of the accountant is not equal to the effectiveness of the engineer.

The executive, in the consideration of management, usually lays more stress upon means of counsel and methods of carrying out orders. From this viewpoint management has been classified into the military and the staff types. The former is a one-man guidance, the latter an administration by a staff of specialists. One of the fundamental differences between these two types is shown in the method of advancing men to higher positions. Seniority counts in the military type, ability in the staff organization. Surely the word manage is not derived from the mere addition of age to a man, any more than is a personage created by adding age to a person.

The operator, who considers the control of the work of prime importance, prefers a classification into the departmental or the divisional type. In the one, control of operations is centralized; in the other the responsibilities of operations are placed upon the local division superintendents. The latter type has been highly developed to meet the needs of railroading and conforms closely to the organization of many great hydroelectric power systems. But for smaller companies most industrial engineers agree that the departmental type is preferable, as the control is simpler and the available talent more efficiently used.

The engineer, figuring on the control of forces, classifies an organization as either undisciplined, disciplined or functional. In the undisciplined organization, where verbal instructions are given, the forces are not under proper control nor are they co-ordinated. In the disciplined organization written instructions at least tell the workers what to do, though task standards are lacking. Discipline is not punishment but teaching, a training for prompt and effective action. A man being disciplined is literally one who is learning. The manager is the teacher, the leader. He should not do, but teach other people to do. Teaching is thus the fundamental function of management.

Functional management, as originally developed by Dr. F. W. Taylor, past president of the American Society of Mechanical Engineers, takes its name from the fact that each man has as few functions as possible to perform. Different foremen instruct the worker what, how, why and when to do. Standards are set and workers intelligently selected in accordance with the requirements of the task, thus permitting the highest efficiency of endeavor. Definite preliminary planning is the chief characteristic of this method, in which unity of purpose, co-operation for a single result, is the keynote.

The engineer is a man of vision, a dreamer who makes his dream a reality by first planning his work and then working his plan. The engineer who understands the principles of accounting and business administration, should be the manager of the great industrial enterprises of the future, for such training more nearly approximates directed efficiency.

While many of these principles seem theoretical the manager whose activity is not limited by the inertia of habit will recognize their truth. Just as the luxuries of yesterday have become the necessities of today, so will the theory of today become the practice of tomorrow.

PERSONALS

John S. Eastwood, consulting civil engineer at San Francisco, is at Sacramento, Cal., on dam business.

A. E. Griswold, of the A. G. Electric Company, Portland, is expected to arrive in San Francisco in the near future.

A. C. Ayres of the Portland Gas & Coke Company, was at Spokane, Wash., from Portland, Ore., during the past week.

F. S. Pratt, vice-president of the Stone & Webster Management Company, is making a tour of Alaska with his family.

F. A. Richards, of Pierson, Roeding & Company, San Francisco, left for a business trip through the northwest during the week.

J. M. Hollas has been appointed agent light and power department, B. C. Electric Railway Company Limited, at Chilliwack, B. C.

L. F. Youdell, manager of the Electric Machinery & Equipment Company of Stockton, Cal., spent the past week in San Francisco.

C. S. Gauntlett, of Pierson, Roeding & Company, San Francisco, left during the week for a business trip through Southern California.

A. E. Poingdestre, manager of the Pacific Gas & Electric Company, Marysville, was a visitor in San Francisco during the week.

H. V. Carter, president of Pacific States Electric Company, San Francisco, is making an extended trip through Southern California.

G. H. Riddock, secretary Bauer Fixture Company, San Francisco, has been elected a member of the Illuminating Engineering Society.

J. Montgomery, contract agent of the Western Canada Power Company at Vancouver, B. C., has returned from an extended summer vacation.

W. L. Goodwin, vice-president of Pacific States Electric Company, San Francisco, returned from a trip to Sacramento the first part of the week.

Geo. C. Campbell, general manager of the Truckee River General Electric Company, Reno, spent a portion of the week on a business trip to San Francisco.

B. H. Hansen, representative of the A. G. Electric Company, San Francisco, recently returned from a business trip to San Diego and Southern California.

Louis C. La Mont, representative of the Westinghouse Electric & Manufacturing Company at Butte, Montana, has returned to Butte from a visit to Seattle.

H. R. Noack, president of Pierson, Roeding & Company, San Francisco, is on a several days' trip to the mountain regions of Plumas County, California.

L. A. S. Woods, special representative of the Detail and Supply Department, Westinghouse Electric & Manufacturing Company, Pittsburgh, spent last week in San Francisco.

E. L. Barnett, chief electrician for the Fort Bragg Electric Company and Union Lumber Company at Fort Bragg, Cal., Francisco, has been elected a member of the Illuminating Society.

Francis Blossom, a member of the firm of Sanderson & Porter of New York and San Francisco, who has been in San Francisco for several weeks past, has left for his home in New York.

W. B. Hall, Pacific Coast representative of Pass & Seymour Company, San Francisco, who has been on an extended Eastern trip is expected home shortly, visiting the Northwest enroute.

Fred S. Mechling, manager of the Nevada-California Power Company, Goldfield, spent a few days in San Francisco during the week enroute to the north, where he intends spending his vacation period.

C. R. Martin has recently come to San Francisco from Milwaukee to join the Pacific Coast sales organization of the Allis-Chalmers Manufacturing Company, making a specialty of hydroelectric installations.

E. K. Patton, Western manager of the Bryant Electric Company, Chicago, arrived in San Francisco Tuesday on a business trip and expects to spend a week or ten days in that section of the state.

K. A. Schaller, railway expert with the Seattle office of the Westinghouse Electric & Manufacturing Company, recently returned to Seattle from an extended trip through Minnesota, Montana, Idaho and eastern Washington.

O. O. Calderhead, statistician of the State of Washington, public service commission, reports that no accidents occurred in that State during 1913 fatal to passengers on electric roads, but reports ten accidents fatal to employees.

W. T. Woodroffe, who recently resigned as superintendent of the Edmonton, Alta., municipal street railway system, is now with the Edmonton Interurban Railway superintending the installation of the first section of the new system.

F. D. Nims, chief electrical engineer Western Canada Power Company, was recently elected chairman of the Vancouver Section A. I. E. E.; K. A. Auty, chief sales department representative B. C. Electric Railway Company at Vancouver, B. C., was elected secretary.

H. A. Johnson has accepted a position with the Utah Light & Railway. Mr. Johnson is a graduate of the University of Utah in 1912. After graduating he entered the apprenticeship course of the General Electric Company at Schenectady. His home is in Ogden, Utah.

H. E. Plank, agent in charge of Seattle office of the General Electric Company, has returned from a trip through southeastern Alaska, where at Treadwell he closed a contract with the Alaska Treadwell Gold Mining Company for electrical equipment, including a 2000 kw. turbine, switchboard and motors.

Olive Huppert, formerly demonstrator for the Utah Light & Railway Company at Salt Lake City, has resigned to accept a position with the Elko-Lamoille Power Company of Elko, Nevada, as demonstrator. B. J. McBride, manager of the company, was in Salt Lake City last week arranging for the opening up of the company's new electric shop and while here Mr. McBride engaged the services of Mrs. Huppert.

H. N. Lauritzen, Pacific Coast manager for the Holophane Works of the General Electric Company, and J. O. Presbrey, traveling representative, have left San Francisco and Salt Lake City, respectively, to attend the convention of Holophane salesmen to be held at Cleveland, commencing July 20th. The convention meetings will be held at Nela Park, where a tented city has been erected by the various association lamp companies for accommodating their conventions.

Helen L. Bartlett, formerly teacher of cooking in the Salt Lake High School, has accepted a position as demonstrator in the electric shop with the Utah Light & Railway at Salt Lake City. Miss Bartlett has made a careful study of the application of electricity to cooking purposes and has written several articles on the subject. It was largely through her recommendation that the board of education of Salt Lake City decided to install electric ranges and cooking appliances in the cafeteria of the new \$100,000 East Side High School recently completed, and also to install electric cooking equipment in the demonstration department of the high school.

J. B. Rannie, who has been connected with the B. C. Electric Railway at Vancouver, B. C., for nearly 25 years, resigned on July 1st. Mr. Rannie's career with the company dates from September, 1889, his first work being the reconstruction of some cars which had been purchased with the idea of horse operation, this in the meantime having been changed to electrical. He then served as motorman and conductor on the city lines, finally choosing the front platform as his permanent position. During his service with the company he has seen the system wonderfully extended. After serving as motorman for a number of years Mr. Rannie was in 1900 appointed traffic superintendent of the Vancouver city lines which post he held until 1911, when he was appointed traffic agent, a position which he filled until the presentation of his resignation. Mr. Rannie will leave the field of electric railway activities to engage in agricultural pursuits at Chilliwack, B. C., where he has purchased a ranch.

MEETING NOTICES.

Electrical Vehicle Association.

The San Francisco Section of the Electric Vehicle Association of America held an enthusiastic meeting last Wednesday and was addressed by Mr. S. Henderson of the transportation section of the Panama-Pacific Exposition. Plans were discussed for participation by the electrical vehicle people in the dedication ceremonies of the automobile section at the Exposition July 15 and ways and means adopted looking toward a strong representation by the electric vehicle in the automobile parade on the same date. Messrs. Cutting, Logan, Perin, Hatton and Cosby were appointed a committee on parade arrangements.

Electric Power Club.

The Electric Power Club held its annual meeting at Hot Springs, Va., on June 8th, 9th and 10th. The organization whose membership is drawn from manufacturers of electric motors and generators has been engaged for the past three years in the important work of standardizing the ratings of electrical machinery, defining the terms and nomenclature used, and establishing standards in many mechanical details on which uniformity of practice is desirable, such as pulley sizes, speeds, shaft diameters, keyways, etc.

One of the most important matters to come before the meeting was the subject of Single Rating and a paper on this subject was read by Mr. Chas. Robbins. In the past electrical machinery has been rated both in terms of load and overload and the relations between the two, the time rating for which the overload was specified and the temperature allowed have all been continually subject to revision, requiring frequent redesign in order to meet the changing specification requirements. Single rating is the expression used to define a method of rating electrical machinery which, with the maximum temperature to which different classes of insulation can safely be subjected definitely known and fixed, rates the motor in terms of a single load rating coupled with a single time rating.

The tendency both in this country and abroad is towards the single rating method. It has already been adopted by the International Electro Technical Commission and is under consideration by the A. I. E. E. All special application motors used in this country are already so rated, such as crane, elevator, machine tool, railway motors, etc. Although there is no condition of load or service which can not be properly expressed in and interpreted by the single rating method, the bulk of general purpose motors are now sold with a time overload rating in addition to the nominal rating and it was recognized that any immediate change of practice would cause considerable confusion in the trade. The members of the Electric Power Club unanimously adopted a resolution expressing entire concurrence in the principle of single rating and instructing the different committees to

constructively work towards the single rating method in all standardization work during the coming year. Recognizing the valuable work that the A. I. E. E. is also doing in this same direction, the committees were instructed to work in thorough co-operation with that body.

Prof. Francis B. Crocker, president of the club, recently submitted a paper to the members giving his views on the proper line of demarkation between the standardization work of various associations whose interests are more or less closely allied. There was considerable discussion of this paper at the meeting and uniform approval of the views given by Prof. Crocker. Applying his ideas to the standardization of electrical machinery, the work of the A. I. E. E. would be in general that of establishing broad engineering and technical limits within which such machinery should be designed, but, provided these limits were not exceeded, the exact basis of commercial rating to be used should properly be left to such an organization as the Electric Power Club, as the manufacturers of electrical machinery are naturally more familiar with any limitations in manufacture which might exist as well as with the necessity of adopting for certain classes of apparatus greater conservatism in the basis of rating than is required where the conditions of load and service can be definitely determined.

The Standardization Committee through its sub-committees recommended a number of standards which were adopted at this meeting. In addition to 115 and 230 volts previously approved, 550 volts was adopted as a standard voltage for direct current motors. Similarly 600 volts was adopted as a standard direct current generator voltage in addition to 125 and 250 volts. The standard voltages for alternating current generators were revised to 240, 480, 600 and 2400 volts. The standards previously adopted for alternating current motors had been confined to polyphase motors and at this meeting standard voltage ratings, temperature ratings, and name plate markings were adopted for single-phase motors.

The following table gives the standards previously adopted for the diameter and face of pulleys for motors of different capacity and speed. The shaft diameter, shaft length and keyway size shown in this table represent the recommendation of the committee on this subject and have been submitted to the manufacturers for careful consideration before adoption.

Motor Rating in H. P.				Standard Pulley Sizes.		Keyway.			
1800	1200	900	600	Pulley.	Shaft.				
r.p.m.	r.p.m.	r.p.m.	r.p.m.	Dia.	Face	Dia.	Length.	Width.	Dpth.
2	1	..	..	4	3	15/16	3	1/4	1/8
3	2	..	..	4	3	1	3 1/2	..	..
5	3	..	..	5	4	1 3/16	4	5/16	5/32
7 1/2	5	..	..	6	4	1 3/16	5	3/8	3/16
10	7 1/2	5	..	7	5	1 9/16	5 1/2	..	..
15	10	7 1/2	..	8	6	1 7/8	5 1/2	1/2	1/4
20	15	10	..	9	7	2	6	..	..
25	..	..	..	10	7	2 1/8	6 1/2	..	..
30	20	15	..	10	8	2 1/4	7	..	..
40	30	20	15	11	10	2 3/8	7 1/2	..	..
50	40	30	20	12	11	2 1/2	8	5/8	5/16
..	50	40	30	13	12	2 3/4	8 1/2	..	..
..	75	50	40	14	12	3	9 1/2	3/4	..
..	100	75	50	16	13	3 1/4	10 1/2	..	..

All standards as adopted are printed in the Book of Standards of the Electric Power Club. This book contains much valuable information on standard ratings of electrical machinery, speeds, guarantees, nomenclature, etc. Copies can be obtained from Mr. C. H. Roth, the Secretary, at 1410 West Adams street, Chicago, Ill.

At the close of the meeting Prof. Francis B. Crocker was re-elected president. Prof. Crocker has been closely associated with both the technical and commercial phases of the electrical industry from its inception and was chairman of the first Standardization Committee of the A. I. E. E. He has done valuable work in connection with the technical standardization originated by that body and is well qualified both from experience and association to lead the work of industrial standardization which is being undertaken by the Electric Power Club.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The San Diego Electric Railroad Company filed an application asking for authority to create a bonded indebtedness of \$10,000,000. The bonds which the company proposes to issue will be known as General First Lien, 5 per cent Sinking Fund 40 year gold bonds, and will be secured by a trust deed of all the railway company's property. The company gives as its reason for creating this indebtedness the necessity for improvement and expansion due to the growth of the community and the expected increase in business which will result from the Exposition to be held in San Diego in 1915.

The commission has rendered a decision authorizing the Southern California Edison Company to purchase 1060 shares of the preferred stock of the Long Beach Consolidated Gas Company at \$80 per share. The Long Beach Consolidated Gas Company has issued 850 shares of preferred stock all of which are owned by the Southern California Edison Company, 5552 shares out of 6757 of its common stock are also owned by the Southern California Edison Company.

The Commission has rendered a decision authorizing the Southern California Edison Company to sell its electric distributing system in San Fernando, Los Angeles County, to the Pacific Light & Power Corporation. The purchase price will be \$9,448.

The Modesto Gas Light Coal & Coke Company, operating in Modesto, Stanislaus County, has filed an application with the commission, asking authority to renew for one year two promissory notes amounting to \$42,778 in favor of Frank A. Cressey.

The commission has rendered a decision in the complaint brought by the city of Monterey against the Coast Valleys Gas & Electric Company. Monterey is one of the cities that has vested its control over public utilities in the commission. The Coast Valleys Gas & Electric Company was organized in 1912 with \$5,000,000 capital stock and authorized bonded indebtedness of \$10,000,000. The city charged that the gas company's rates were unreasonable. The gas company denied this and asked the commission to fix rates which would allow a return of 10 per cent on the full estimated reproduction cost of its property. The rates as finally determined by the commission will reduce the top rate charged by the gas company from \$1.50 to \$1.30. It is estimated that the rates as established by the railroad commission will allow the gas company a return of 8 per cent on the commission's valuation of the property.

The commission has rendered a decision authorizing the Pacific Gas & Electric Company to issue bonds as follows: 1—\$5,000,000 par value general and refunding mortgage gold bonds. The commission to determine in a supplemental order the minimum price at which they are to be sold. 2—\$12,500,000 par value first preferred stock at not less than \$82.50 per share and as much additional as may be necessary to exchange for original preferred stock after July 1, 1916, at the rate of 1025 shares of first preferred stock in exchange for one share of original preferred stock up to a maximum of \$10,000,000. 3—\$1,159,800 par value of common stock for the reimbursement of moneys expended for the retirement of bonds through sinking funds from January 1, 1914, to April 30, 1914, and to provide cash for meeting certain sinking fund obligations.

The commission has rendered a decision in which it finds the present value of the operative property of the Ocean Shore Railroad Company as of June 30, 1912, to be \$4,627,319.40.

The commission has rendered a decision dismissing the application of the Southern Counties Gas Company to issue \$5000 bonds. An application of the same company, asking the commission to approve its action in depositing bonds of the par value of \$15,000 for sinking fund purposes was also dismissed. The action taken in both cases was at the request of the gas company.

TRADE NOTES.

The Oro Electric Company will move its general offices from San Francisco to Stockton, Cal., August 1st.

Allis-Chalmers Manufacturing Company has been awarded an order for a 2000 kw. motor-generator set to be installed in the Jessie street plant of the Pacific Gas & Electric Company at San Francisco.

Chas. C. Moore & Company, Engineers, has secured through the Seattle office an order from the Alaska Treadwell Gold Mining Company for the installation of an additional 1200 kw. steam turbine unit to the present steam plant. The order was taken by H. W. Beecher, who recently returned from Juneau.

F. C. Perkins, of the Perkins Electric Company, has purchased the good will, shop and office equipment of the Reynolds Electric Company, at 310 First avenue South, Seattle, and will conduct the business in association with H. F. Reynolds. A large stock of new and used electrical machinery will be kept at Seattle, Vancouver and Portland.

The municipality of Seattle has awarded a contract for three 4700 k.v.a. oil insulated, water cooled transformers to the Allis-Chalmers Manufacturing Company of Milwaukee, Wisconsin. These transformers will be used to step up the 2500 volt 2-phase current from the 7500 kw. steam turbine unit recently purchased from Allis-Chalmers Manufacturing Company for 60,000 volt distribution in the city's transmission system. These transformers will be installed in the new steam auxiliary plant at Lake Union and will be delivered in September.

Some excellent reports have been received recently on the life of mercury rectifier bulbs used on constant current arc lighting circuits. These bulbs are guaranteed for an average life of 500 hours, but this guarantee is being generally exceeded, and in some instances an average life as high as from eight to fifteen times the guarantee has been obtained. The report of the Peoples Gas & Electric Company of Savanna, Illinois, recently issued, is an excellent example of what results are often obtained with a but slight attention on the part of the operators. This report showed an average bulb life for the last three years of 8398 hours. It should be noted that this life is not the individual life of bulbs but the average life, for some bulbs still in service, are operating in the neighborhood of 9000 hours. Mr. T. P. Bowen, manager of this plant, attributes this extra long average life to the fact that the bulbs are, as per instructions of the manufacturer, operated on short circuit for four or five minutes each night before throwing on the lamps. In addition to this treatment, the bulbs are occasionally taken from the tank and "rested" for a week or more and are also given an occasional hot water bath.

Confidence in the future of California oil resources has again been evidenced by the award in San Francisco of a large contract to Sanderson & Porter, the well known firm of engineers, for the entire installation of a pipe line for transporting oil from the great San Joaquin oil fields to tide water. The contract was consummated June 4th between Sanderson & Porter and the Valley Pipe Line Company. The latter is a \$10,000,000 California company organized to handle this portion of the Shell-Royal Dutch Syndicate's California oil business. For the economic delivery of California oils through long pipe lines, it has become standard practice to heat the oil at each station, thereby reducing its viscosity and lowering the pumping pressure required. High thermal efficiency is secured by using the exhaust steam from high duty pumping engines at each station. Construction work on the pipe line is now being actively prosecuted, many surveys having been completed, and orders placed with the Youngstown Sheet & Tube Company of Youngstown, Ohio, for 175 miles of line-pipe, and with the Llewellyn Iron Works of Los Angeles, California, for the necessary equipment for station boilers of the Heine type.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell, Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correlate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

Grounding the Neutral of Low Voltage Systems.

BY THE SECRETARY.

Grounding the neutral wire of 3-wire systems will (1) prevent a break in the neutral wire of the street service, causing higher than the normal voltage to enter some of the circuits due to unbalancing; (2) will minimize the life and insulation hazards due to sneak currents; (3) will, if the ground connection is made within the building and includes all complete metallic underground piping systems, prevent the hazard due to stray street railway currents.

The breaking of a neutral of the street service is an accident which occurs more often than is generally supposed. When this occurs the lamps of some of the circuits will glow with exceeding brilliancy while those of other circuits will glow correspondingly dim. In extreme cases lamps may be burned out and wires heated. Grounding the neutral wire at the generator or transformer and at intervals on the line will cause the unbalanced current to return through the ground.

The origin of the sneak current is subject to much difference of opinion. Damage is effected which in the opinion of experts could not be accomplished by the normal voltage of the circuit; but when a test is made normal conditions prevail. The probable cause is leakage from the primary to the secondary coils of the transformer coincident with leakage on one of the primary wires which may be momentary; this condition may cause a current of small volume but of high pressure to seek a passage to the ground over the wires of the secondary circuit. The high pressure small volume current creates a path which the current of the low voltage system will follow. This condition is especially destructive to the insulation of motor windings and is the probable cause of many deaths, grounding the secondary system will provide a free passage to the ground for the sneak current.

Street railway currents travel from the generator over the trolley wire, through the mechanism of the car to the rails and are supposed to return over the rails and through the earth to the generator; but much of this return current jumps to adjacent underground piping which may run parallel with the track. Leads from such piping systems may cause stray currents to enter buildings at a potential somewhat higher than the surrounding earth and return through other piping systems; may arc to other piping system to which it is in contact but not electrically bonded. The grounding of the neutral within buildings to all available underground piping will also provide a bond which will eliminate the stray current hazard so far as the building is concerned.

To protect a building and its occupants from fire and life hazards by precautions taken within the building seems desirable. To ground the neutral at the point where it leaves the service conduit and before it enters the service switch seems to be the most logical method as a ground connection at that point will give the most complete protection against unbalancing and from sneak currents, as well as

eliminate the aforesaid stray current hazard. A very reasonable objection to grounding the neutral of underground systems at each distribution box through the box is set forth by power companies because the grounded neutral offers a path for the return street railway currents which will cause a drop of potential in the three-wire circuit while heavy traffic passes certain points, a source of much annoyance.

The above statements are based upon the assumption that neutrals are grounded at the generators and transformers.

Rule 15 N. E. Code, gives complete data on methods for ground connections.

RULING ON NITROGEN FILLED LAMPS.

James M. Barry, chief of the department of electricity of San Francisco, has approved the installation of the new 750 watt and 1000 watt nitrogen filled lamps when installed in accordance with the provisions of Paragraph 2, Section 23-d, of the National Electrical Code, which reads as follows:

By special permission, in cases where wiring equal in size and insulation to No. 14 B. & S. gage approved rubber-covered wire is carried direct into keyless sockets or receptacles, and where the location of sockets and receptacles is such as to render unlikely the attachment of flexible cords thereto, the circuits may be so arranged that not more than 1320 watts (or thirty-two sockets or receptacles) will be dependent upon the final cutout.

ELECTRICAL CONTRACTORS' NOTES.

The National Ice & Storage Company at East Water and Washington streets, Portland, Oregon, have awarded the electrical contract in their building to B. E. Davies.

The electrical contract for the three-story apartment house of A. C. Bernitt has been awarded the Groud Electric Company of Portland.

The electric fixtures for the Piedmont Presbyterian church, three story concrete, located at Cleveland avenue and Jarrett streets, Portland, have been awarded to the J. C. English Company, also the Westminster Presbyterian Church, east Sixteenth and Schuyler streets.

The electrical work in the two story brick garage, located at east Third and Oregon streets and owned by F. Kiernay, has been awarded to the NePage, McKenny Company of Portland.

The Tuerck-MacKenzie Company has the contract for the electrical work in the Clifford hotel, located at east Sixth and Morrison streets, Portland.

Oregon Electrical Ordinances.

	Date passed.....	License fee on bond for Contractor.....	Permit fee.....	Ordinance requires conduit in fire limits.....	Inspection charges.....	Inspectors
Ashland.....	1/21/13	No	No	No	No	H. G. Butterfield
Albany.....		Yes	Yes	No	No	Griff King
Astoria.....	5/13/13	No	No	No	No	C. E. Foster
Baker.....	3/27/14	\$20.00	50c	Yes	No	F. H. Grabner
Dallas.....	1/16/13	No	No	No	No	E. J. Himes
Eugene.....	8/12/13	No	Yes*	No	Yes†	W. H. Alexander
Grants Pass....	1/24/13	No	Yes	No	No	C. E. McLane
Hillsboro.....	2/ 4/13	No	No	No	No	J. H. Hensley
Independence.....		...	...	...	...	H. A. Bottomly
Klamath Falls..	9/22/09	No	No	No	Yes*	C. E. Meldrum
La Grande.....	6/ 3/14	\$20.00	50c	Yes	No	W. A. Benham
Medford.....	1/21/13	\$10.00	No	No	No	L. E. Hinman
Marshfield.....	8/10/09	\$25.00	50c	No	†	C. W. Tribbey
	7/ 1/13 amended					
Pendleton.....	5/20/14	No	No	No	No	Cliff Bellinger
Portland.....	6/24/10	\$500 bond	0	0	0	E. F. Dunlap
Roseburg.....	4/22/12	\$500	0	0	0	H.W.Worthington
		\$510				
Salem.....	4/ 7/13	No	No	No	No	P. McCrackan
Sheridan.....	1/14/13	No	No	No	No	E. N. McGann
The Dalles.....	5/21/14	No	No	No	No	Roy Marshall

Note:—*A graduated scale.

† A special charge made for extra inspections.



NEWS NOTES



ILLUMINATION.

AUMSVILLE, ORE.—The town authorities have granted a lighting franchise to the Aumsville Flour Mills.

WHEELER, ORE.—Wheeler is to put in its own electric light system, power being furnished from the water system.

NEWPORT, ORE.—The Yaquina Electric Company, Newport, Oregon, began the operation of its Toledo plant early in June.

CHEHALIS, WASH.—B. F. Walling wants a new light and power franchise in Chehalis. There is some objection to a 50 year franchise.

SEATTLE, WASH.—Bills have been passed for the appropriation of \$125,000 to complete the first unit of the auxiliary steam plant now under construction.

NOGALES, ARIZ.—Spiro S. Proto and Monte M. Mansfield, who were granted an electric light franchise here recently, are arranging to begin installation in a short time.

EUGENE, ORE.—The Oregon Power Company is engaged in a power war with the municipal lighting plant. The city has entered complaint alleging bonuses, rebates, etc.

VALLEJO, CAL.—The city council has awarded the contract for 40 electroliers to be installed on Virginia street, to the Pacific Fire Extinguisher Company at the price named in their bid, \$4920.

LOS ANGELES, CAL.—Bids will be received by the board of supervisors of Los Angeles county up to July 20th for furnishing electricity and maintaining lights in Greer Meadows Lighting District No. 1.

WENATCHEE, WASH.—The Wenatchee Valley Gas & Electric Company, Wenatchee, Washington, has announced a reduction, amounting to about 30 per cent in the residential and commercial use of electricity.

AUBURN, WASH.—The Auburn Gas Company has had engineers at work the past few days surveying to lay pipe and a plan of this will be filed with the council for approval. The company is capitalized for \$50,000.

SEATTLE, WASH.—The city council has passed an ordinance appropriating \$125,000 from the light fund to complete the first unit of the steam plant. The supreme court has decided in favor of the validity of the bonds for \$425,000 for the construction of the auxiliary steam power plant on Lake Union.

ANCON, CANAL ZONE.—The electric light and power plant at Empire was shut down July 1, and hereafter, current for light and power will be supplied the towns on the west side of the canal from the Miraflores steam plant. In using current from the Miraflores plant, the existing overhead lines were connected to the submarine cable which crosses the canal at Cucaracha for the operation of the relay pumps on the west bank of the Cut in connection with the work of dredging. Some of the transformers were changed on account of the change in frequency from 60 to 25 cycles.

SACRAMENTO, CAL.—The state board of control and Superintendent of Capitol Buildings and Grounds George Radcliff won their fight for the retention of the old lighting rate for the capitol where the bids were opened last week. Previous bids refused by the board raised the old rate from 1½c per kilowatt-hour to 3 cents. The bid of the Pacific Gas & Electric Company was 2½ cents for power and 3c for light. The bid of the Great Western Power Company, holder of the present contract, calls for the continuance of the present service without a formal contract under the old price of 1½c until an indefinite time in the future, where it is suggested the matter may be taken before the railroad commission for an adjustment.

LOS ANGELES, CAL.—Relative to what course his office will pursue in handling the gas rate question in court and in order that the public may have an understanding of the entire situation, not only as to his ideas, but as to the law, City Attorney Stephens has issued the following statement, showing that the real fight will occur if the Los Angeles Gas & Electric Corporation contests the 40c natural gas rate fixed for the ensuing fiscal year. "If a temporary order should be granted in the Los Angeles Gas Company's case the court would probably request that a temporary rate be agreed upon, the difference between such agreed rate and 40c would be impounded until final determination of the matter. Any such temporary rate would be suggested by the council. The court could, and might in this case instead of impounding the difference, require the filing of an indemnity bond. My policy in the gas question, is and will be as follows: Exert every effort to get natural gas distributed, and much as possible—first to domestic consumers, then for industrial consumption. Resist every attack on the legal rate as fixed by the council revaluing the company's investments and cost of distribution, and I am highly pleased that Mr. Mulholland will undertake the task of superintending such a revaluation."

TRANSMISSION.

WHITE SALMON, WASH.—The Northwestern Electric Company will shortly start the construction of another power house on White Salmon River, 12 miles from White Salmon.

LEWISTON, IDAHO.—The Lewiston-Clarkston Improvement Company has inaugurated construction on the extension of its power lines to Lapwai. The line will be completed by September 1st.

JEROME, ARIZ.—An ordinance has been adopted by the common council granting a franchise to the Upper Verde Public Utilities Company, to purchase and operate an electric lighting and power system, heating and cold storage system, telephone-telegraph system, gas plant and system, water system and sewer system.

EUGENE, ORE.—With surveys and preliminary work on the power project of the Oregon Electric Clear Lake completed, negotiations are under way for the necessary power rights, and the railroad expects permission within 90 days to go ahead with construction upon two plants to produce 90,000 h.p. for distribution all over Oregon.

OROVILLE, CAL.—The Great Western Power Company has placed a larger force of men at work on its project in Big Meadows. The head dam across the Feather River is to be raised ten feet this summer. The dam is now 65 ft. high. This addition to the dam is needed because of the new units being added to the power plant at Big Bend just above Oroville on the Feather River.

EUGENE, ORE.—Water rights to be granted by the state and by the United States government to make possible actual construction on the \$5,000,000 power project of the Oregon Electric at Clear Lake, 75 miles east of Eugene, are expected within 90 days, according to L. C. Gilman, president of the electric road, who was in Eugene today. Surveys and preliminary work have been completed and the final negotiations for permission to start work are now under way. The project includes the construction of a canal from the lake, which is on the summit of the Cascades, and two power plants, which, combined, will generate 90,000 possible horsepower. The final estimates of the engineers, with tests and measurements taken during a period of three years, were completed this spring and are said to have been accepted.

SACRAMENTO, CAL.—Water power projects which will Water Commission, and now holds permits to operate, according to a report covering the first two years of its existence. The largest of the projects now holding permits is that of the Yolo Water & Power Company on Clear Lake and Cache Creek, which will cost \$5,185,000, and is to develop 49,000 h.p. The other holders of permits for projects now in course of development are one of 1000 h.p. on Boulder Creek; Salva Olser, \$7500, 100 h.p., north fork of Feather River; J. F. Thompson, \$4000, 100 h.p. Volcano Canyon; C. E. Loose, \$422,301.90, 10,420 h.p., East Walker, Birchville Mining Company, \$30,000 300 h.p. Weaver Lake; R. G. Gillespie, \$18,500, 200 h.p. North Yuba River. Three of these projects must be completed during 1914, one in 1915, two in 1916, and one—that of the Yolo Water & Power Company—in 1919, in accordance with the time limits fixed in the permits.

TRANSPORTATION.

DIXON, CAL.—The Sacramento Valley Electric Road has been refused permission to run its tracks on First street, the principal business thoroughfare of this city.

WALLACE, IDAHO.—The Interstate Callahan mine is contemplating the construction of an aerial tramway to connect it with a 9 mile branch of the N. P. Road, 2 miles.

ASTORIA, ORE.—The council has granted modified franchise asked for by the Pacific Power & Light Company for proposed extensions in the east and west ends of the city.

LOS ANGELES, CAL.—A franchise for the construction of an elevated railway from the rear of the Pacific Electric station at Sixth and Main streets to San Pedro street, has been ordered sold to the Pacific Electric Company by the city council.

SAN FRANCISCO, CAL.—President Jesse W. Lilienthal of the United Railroads has expressed his willingness to enter into negotiations with the city for the sale of the United Railroads on the plan proposed by the public utilities committee of the supervisors.

SAN DIEGO, CAL.—Sealed bids will be received up to July 27th, by the common council of San Diego, for a franchise granting the right to construct a general commercial railroad along certain streets and places in San Diego, for a period ending December, 1952. The franchise has been applied for by the Bay Shore Railway Company.

TUCSON, ARIZ.—Arrangements have been concluded between the Tucson Street Railway Company and owners of property beyond University avenue for the extension of street car service from the present terminus on University north on Park avenue to Speedway, and east on Speedway. The extension, together with equipment, will cost about \$25,000.

OAKLAND, CAL.—The contract for the superstructure of the new class C headquarters of the San Francisco-Oakland Terminal Railways at Twenty-second street and San Pablo avenue, has been awarded to Bacens & Kennedy for a figure slightly in excess of \$20,000. This firm has placed the foundations of the building and will start work on its new contract immediately.

SAN FRANCISCO, CAL.—Negotiations that have been pending with the O'Neill estate over the purchase of a part of a block of land for the municipal street railway car barn at Seventeenth and Hampshire streets, were concluded a few days ago by City Attorney Long for \$44,750. The estate claimed the land was worth \$55,000 and the city ordered the land condemned. The city attorney held it was better to pay \$44,750 than wait the delay of condemnation proceedings.

SAN FRANCISCO, CAL.—The Geary Street Railroad earned \$136,430.20 for the fiscal year ending June 30. The earnings of the Union Street Road are estimated at \$53,000, this line having been taken over by the city in December. The gross receipts of the Geary street line for the year were \$641,374.48, and those of the Union street line for the seven months under municipal management, \$189,535.37. No allow-

ance is made in the statement of the Geary and Union street lines, as given out, either for depreciation or for the taxes which would have been paid had the roads been under private management. The statement of the Geary street line earnings is:

Gross receipts	\$641,374.48
Expenses—	(
Operating	\$297,025.14
Sinking fund	115,447.41
Interest on bonds	88,603.55
Liability insurance	3,866.18
Net earnings	\$504,944.28
	\$136,430.20

TELEPHONE AND TELEGRAPH.

FLORENCE, ORE.—The Suislaw Home Telephone Company has made arrangements to build a line from Florence to Heceta lighthouse.

EUGENE, ORE.—The county court has granted a franchise to the Suislaw Home Telephone Company to operate a telephone line over the county roads in lower Suislaw around Florence.

NOGALES, ARIZ.—Improvements are under way at Nogales, which when completed, will give the city a complete new telephone system. New equipment, poles, cables, switchboards, etc., are being installed.

HELENA, MONT.—The Helena Automatic Telephone Company discontinued service on July 1st. The action of local business men in taking out their phones has reduced the number of subscribers below a profitable basis.

CHEHALIS, WASH.—The Evergreen Telephone Company has applied to the county commissioners for a franchise northeast of Centralia. The Klickitat Telephone Company has applied for a franchise to operate through Glenoma, Nesika, Kosmos and Riffe and Mossyrock in East Lewis county. The hearing is set for July 7th.

WATERWORKS.

ZILLA, WASH.—Negotiations are pending between the Zillah waterworks and the town regarding the proposed sale of the plant. The system is owned by Walter N. Granger Jr. and is offered for \$12,000.

SAN BERNARDINO, CAL.—Immediate construction of a filter to purify Lytle creek water before it enters the reservoir, is now planned by the water commission, and Superintendent Harris is working on the project.

CHEHALIS, WASH.—T. C. Rush and the city commission have worked out a plan for the purchase of the water system. The city agrees to pay Mr. Rush \$30,000 for his holdings in the plant, \$11,000 in bonds and \$19,000 out of the revenues.

SPOKANE, WASH.—Commissioner of Public Utilities C. M. Fassett is contemplating improvements at the up river pumping plant in the way of an auxiliary water station with pumps to be driven by water power that will cost from \$100,000 to \$125,000.

GLENDAL, ARIZ.—An election will be held July 21st to vote on bonds in the sum of \$248,000 for the purchase of four water plants supplying water to the city. Of this sum \$159,000 will be used to purchase the systems and the remainder for extensions.

PORTLAND, ORE.—Preliminary work on the construction of the dam to raise the intake at the headworks of the Bull Run pipe line which has long been contemplated, will begin this summer. The dam will be of reinforced concrete and will cost approximately \$100,000.

SAN DIEGO, CAL.—Edwin Duryea, Jr., special hydraulic engineer, retained by the water commission, has filed his report recommending the spending of \$470,000 of the recent water bond issue. Two big items recommended by him are the Dulzura conduit, to cost \$185,000, and the development of a complete pumping plant in San Diego River at a cost of \$200,000. Lesser items include improvements and repairs to the Dulzura conduit, \$30,000; pumping plant to save Otay seepage, \$5000; and \$50,000 for engineering investigation.

ALPHABETICAL INDEX TO ADVERTISERS

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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VOL. XXXIII No. 3

SAN FRANCISCO, JULY 18, 1914

PER COPY, 25 CENTS

THE EASTWOOD MULTIPLE-ARCHED DAM.

BY JOHN S. EASTWOOD.

EXPERIMENTS WITH SUSTAINED HIGH FREQUENCY HIGH VOLTAGE.

BY J. C. CLARK.

HYDROELECTRIC COST DATA.

BY J. D. ROSS.

THE DIESEL ENGINE.

THE TELEPHONE PROBLEM.

BY D. P. FULLERTON.

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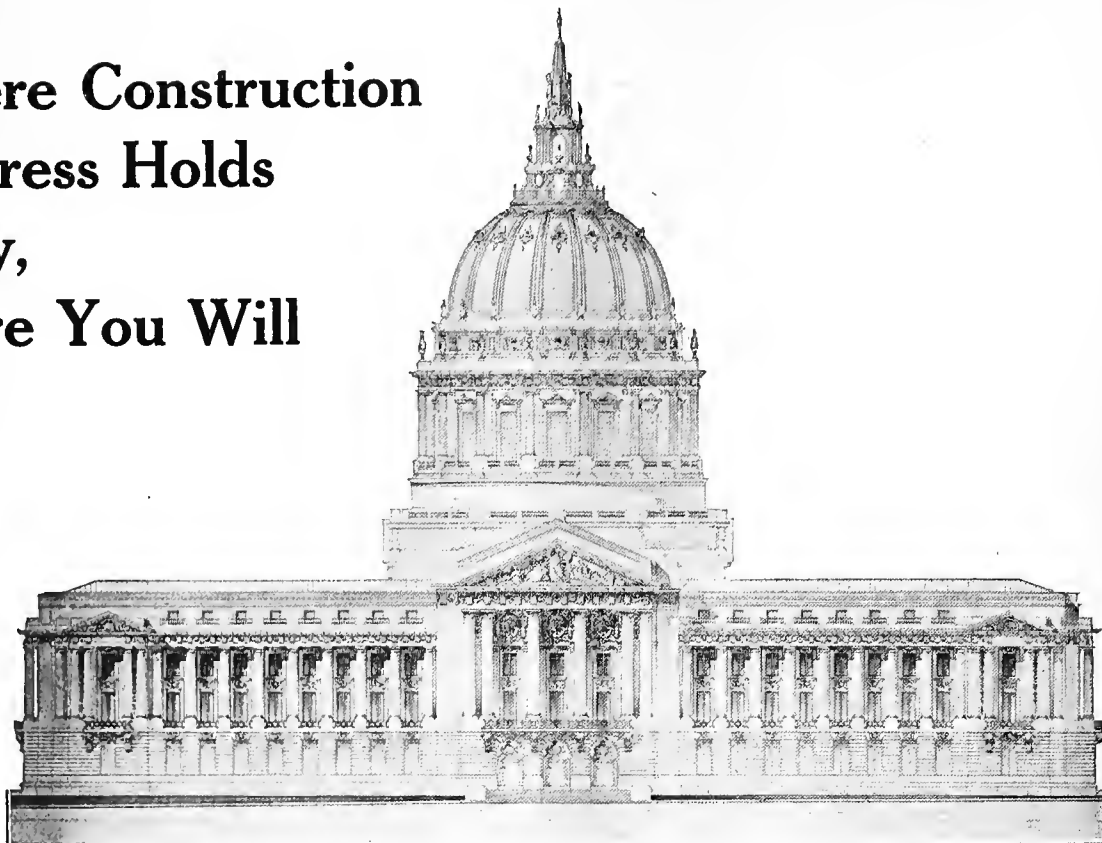
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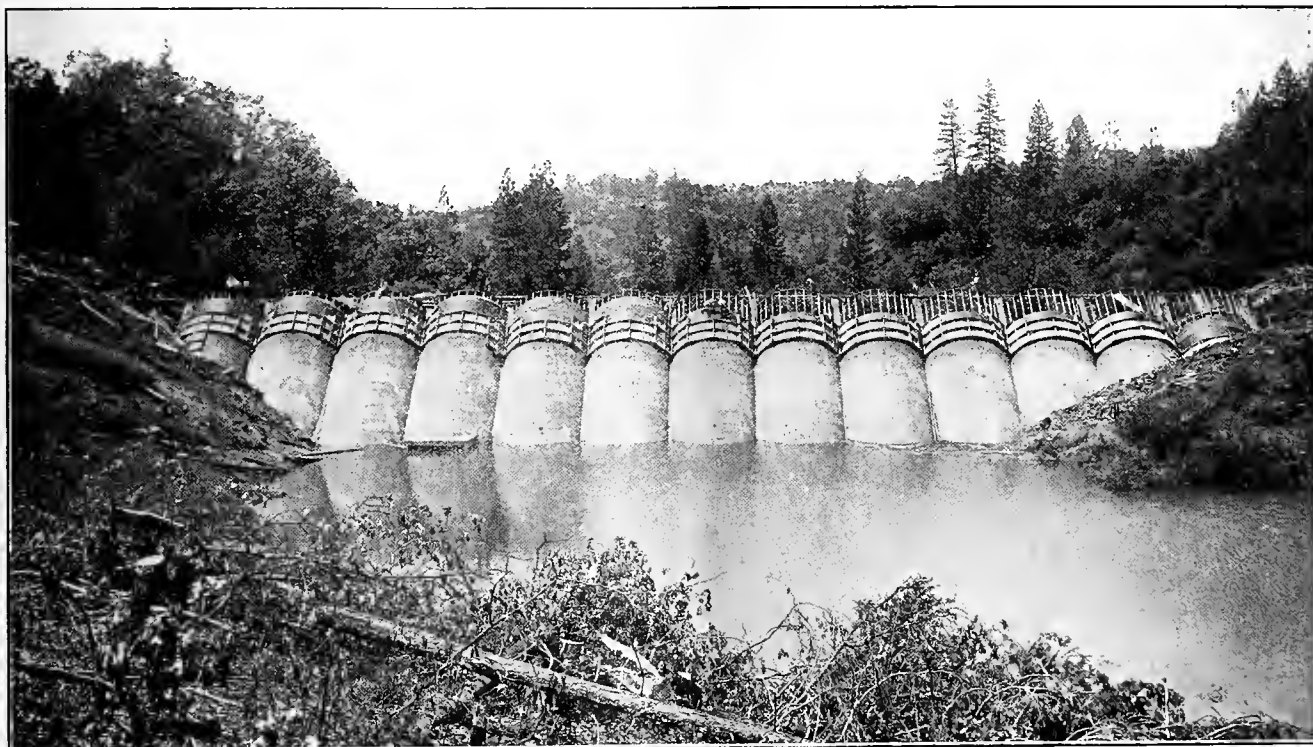
NUMBER 3

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THE EASTWOOD MULTIPLE-ARCHED DAM

BY JOHN S. EASTWOOD.

(This paper constitutes a critical discussion of the several features of efficient dam design, particular stress being laid on the fact that each dam site requires a design especially adapted to it.—The Editor.)



Downstream View of Eastwood Multiple Arch Dam.

The perfection of the design of dams that shall be the last word on the subject can only result from long study, intimate analysis, and practical experience in their erection.

The only genius is a large capacity for hard work. Any approach to the evolution of a perfect piece of apparatus for a given function depends on an intimate knowledge of every feature of the problem under consideration. The analytical chemist uses many fine sieves and uses many tests to determine the final resultant components of a substance. Likewise, the engineer who would design a nearly perfect work must first analyze for basic principles and then construct a synthetic structure based on the results of the analysis.

It is only in this way that the goal of complete perfection is reached.

Usually we do not appreciate the intricacies of a problem until we start to solve it. We then unfold, one at a time, the basic factors of the problem and must give them their true weight in the final result. In the design of multiple-arched dams, there are a great number of these basic factors to consider, and they are so inter-related that not only must their influence be considered, but each must also be considered in connection with its relation to the other basic factors.

The fundamental problem of dam design is to provide a barrage for water, or other liquid, at a minimum of cost and a maximum of safety and permanence, in other words of the highest efficiency.

The result can only be attained by the application to each particular problem of the basic principles of each feature in the design and its true value

and weight in the problem.

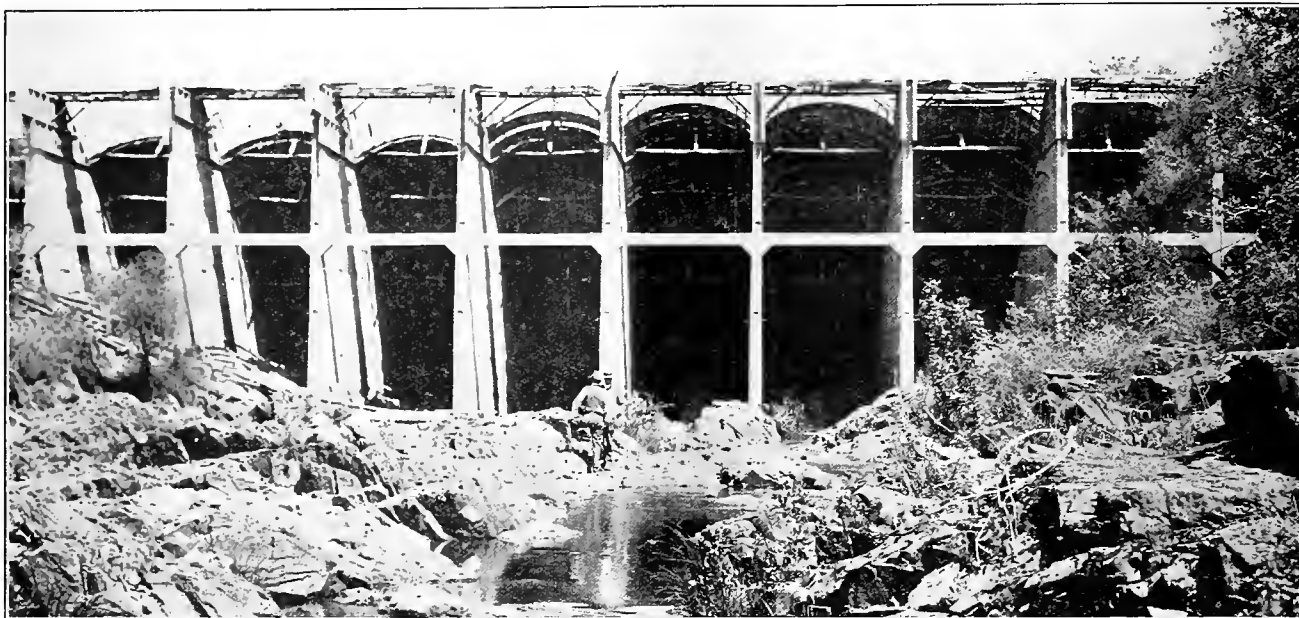
The novice will find himself using assumptions, taking for granted certain rules, which on more complete analysis he will find lead to far different results than was expected and assumed.

The song runs, "Every little movement has a meaning all its own," and this is especially true in the design of multiple-arched dams where the movement of one feature may put some other vital feature beyond the edge of safety limits.

The dams that go out are the dams designed by novices, because in the nature of things it is impossible for the novice to foresee results.

All over the world large sums of money are being sunk in the erection of inefficient dams, and in no other kind of structure is there such economic waste as in dams.

One reason for this is that the rarity of the use of this kind of structure leaves most engineers novices through lack of practice and experience in their



Upstream View of Eastwood Multiple Arch Dam.

The theoretical is always the framework, and on it must be placed the body of the practical structure.

The matters of the economic slopes, spans, angles of arc and other features are all determinable, but they are also all inter-related and interdependent, and for that reason each dam site requires a design especially adapted to it. Any one of these dimensions can be varied through a definite range and still maintain the structure within the limits of safety, but it will not meet the important condition of best efficiency, unless each sustains its proper relation to all of the others.

To reach maximum efficiency, it is necessary for the designer to select the proper dimension for each of the above elements of design for the particular site under consideration.

The trend of thought of the novice in design is to copy dimensions from existing works and apply them to the problem in hand, assuming that they should be right or they would not have been used in the design. The reason for their use in the original design is overlooked.

Another feature one sees is the crudity of design, and the all too apparent overlooking of the essentials to maximum efficiency.

Dams of all types are being designed by novices purely by guess and by the rule of thumb.

The more efficient a piece of apparatus is, the more complex the design, even though the resultant structure may be simple in itself, and simplicity itself to the expert designer.

design and construction. The only safe course for the novice is to hold to the traditions of design and to copy works that are standing, for the subject is too large to be consummated in the time he has to give it. Like a babe learning to walk, hesitatingly holding fast to a chair, before he starts to his mother's arms, the novice in design feels safe from falling as long as he clings to tradition for support.

The perfect solution of the problem will be most nearly approached when a design is provided that will give as nearly equal strength in all parts as the conditions of service to be performed will permit.

This is the general rule for multiple-arched dam design.

We cannot reach the resultant of highest efficiency unless we can integrate the values of each factor or the design in itself and also in its relation to all of the other factors.

It is assumed that the only material available adapted to the design is Portland cement concrete.

The controlling factor is stress, or the work the structure is to perform. The forces acting to set up stresses are the water pressure, the weight of the materials of the structure, and the changes in the volume of the materials due to temperature change above or below temperature of erection and the moisture content variation. Having selected a proportion for the concrete such as will give the most economic result, the permissible loading will then be determinable and a safety factor chosen, based on the ultimate strength of the concrete.

This is the initial factor, for upon it depend all dimensions of the design.

The safe load on plain concrete of the best quality, in compression, (and no other than best quality should be permitted or considered), is given by the best authorities at from 400 to 600 lb. per sq. in. This is usually based on an ultimate crushing strength of 3000 lb. per sq. in., and will consequently give safety factors of 7.5 against crushing. The safety factors used by the author are 10 and over.

Having determined the loading and safety factor in the concrete, the next step is the design of the structure itself.

It must be remembered that there is an economic point for the slopes, of the water face and back edges of the buttresses, of span and of arc, all of which are dependent on the allowable loading.

Consider first the slopes of the up-stream and down-stream faces. These must be such as to place the resultant of the loading over the center of the base area of the buttress foundations, for all but the top sections. This gives absolute stability. The slopes will depend on the ratio of the weight of masonry and the superimposed water loading. As the water loading is in a constant ratio from 0 at the surface and increasing regularly with depth, the weight complement of the water load will depend on the slope of the water face.

The flatter the slope of the water face, the greater the water load complement, and the less the required masonry load for stability.

The flatter the water face the steeper the water load resultant, which also affects the masonry load complement required.

As the buttress slopes front and back may vary through quite a range without great alterations of quantity, though there is an economic point, the water face slope is really more influenced by the allowable loading in the masonry and this by the span and angle of arc used.

Having the unit loading, the span must be determined as well as the angle of arc of the arch dam before the economical slope is determinable.

The span is influenced by a number of conditions, only a few of which are independent of the conditions at the site under consideration.

Among the influences affecting the economic span are, in the order of their importance:

1. The configuration of the site.
2. The allowable loading.
3. The height of structure.
4. The depth of excavation.
5. The unwatering difficulties.
6. The cost of form materials.
7. The availability of rock for puddling stones.
8. The cost of transportation.
9. The combination of or omission of any of above.

The required amount of buttress area is the same for all spans for equal loading below the point of full loading, but the heads of the buttresses must have a mechanical thickness so that there will be more material used with shorter spans.

Shorter spans also call for more forms, more pits, a smaller percentage of puddling stones, and possibly unwatering difficulties, but at the same time the arched face will increase directly with the increase of the span.

Thus it is seen that the true economic span is determined by a summation of the positive and the negative influences at each site and these must be determined in their true economic value by sound engineering judgment in each case. Therefore there can be no stock economic span.

As the quantities in the arch rings in any case increase directly with the spans, when using the economic angle of the arc, the weight of the structure and the resultant slopes depend on the span. For balanced stability they will be steeper for a heavier structure.

A heavy structure is a result of a light loading or an uneconomical span.

For the economic design, the quantities will vary with the initial loading allowed.

The quantities and consequent cost depart rapidly from the economic point, due to faulty design.

There is also danger in the unbalancing of the design of setting up stresses in excess of good practice, along with the lack of economy.

As to the water face arches, it must be remembered that this feature is the most vital part of the structure, for it is the real dam or water stop, while the buttresses merely support it.

In the arch we transmit and distribute the load to the buttresses, to be taken by them as loaded columns to the foundations.

There is an economic arc of quantity and another for quantity plus stress. Which one we use depends on the depth of the water resisted.

The arched deck must carry its load and do so with the least stress for a given quantity of material in it. The arched deck must also be impervious. To be impervious it must either be dense or be provided with a water-tight skin, supported by the wall.

Thinness does not mean either weakness or perviousness. Thickness does not mean imperviousness or strength, so it is not a question of thickness of wall for imperviousness or for strength, but of one of sufficient thickness for the economic handling of the load, and the making of this wall water-tight.

The arch ring thickness should taper evenly, and should not be stepped, both because the re-entrant angles are lines of weakness, and because they are more expensive to build.

The thickness is not determined as at a fixed relation to the height, but the actual stresses set up by the water load, due to depth below the possible surface.

The initial stresses are computed by the well-known ring formula, $T = pr$, in which T is the tangential thrust, p the pressure due to depth per unit of area, and r the radius of the extrados of the arch ring.

The initial pressures are normal to the surface, and are therefore radial and set up in the arch ring tangential stresses.

The assumption is made that the line of pressure is at the middle of the arch ring. This is true only of the infinitely thin ring.

It lies inside of the middle line of the ring, a fact to be borne in mind in considering the stresses in a thick arch with small arc and high initial loading, as the stresses set up by rib shortening, due to the water load and temperature change, are very much increased by the shortening and thickening of the arch ring.

The subject of arch stresses is too large and

covers too much ground to be more than touched upon in this article.

Suffice it to say that the reinforcement of arches with steel is in the nature of an insurance against the localization of cracks, and for this it must be proportioned as a percentage of the area, and when the arch rings are very thick the quantity of steel increases and its efficiency decreases proportionately.

The reinforcement in an arch of very thick section to be effective must vary in proportion to its lack of efficiency, hence the percentage must increase more rapidly than does the thickness to remain equally efficient.

The arc of the arch must be considered in its relation to quantity for stress, and this leads to the economic arc. The economic arc, quantity for stress, is the equal or more than the economic arc for quantity.

The volume change stresses in the arch may be set up by one or a combination of all of three different agents, namely, the water load, which combines with the normal component of the weight load, which is constant and varies with the thickness; the temperature changes, which may be plus or minus in their relation to the water load, but will always be minus in practice and act with the water load; the moisture content changes, which may be plus or minus to the others, to say nothing of Poissons ratio, which is a component depending on the slope, is constant, and tends to resist the water load.

The temperature drop is always more in a thick than in a thin wall, for the reason that the rise of temperature is greater in the setting process and the fall is to that of the water normal temperature.

The total range of change of temperature is greater from the mean temperature with a thin wall, but the total change from temperature of erection to mean water temperature is less.

As the temperature drop acts with the water, and a rise of temperature can only take place when the reservoir is empty, the drop is the critical point, and is maximum in a thick wall.

The strength as well as the efficiency of the arch lies in its comparative thinness.

Knowing all of the stresses, their value and directions, the safety factors can be determined absolutely. The safety factors are the things of most importance, and can only be determined by complete analysis of the individual project.

The maximum efficiency can only be obtained by making the safety factors of all the elements as nearly equal as possible, when the result will be the cheapest and strongest structure possible.

The structure must have either a solid foundation or a tight cut-off wall.

There can be no uplift thrust possible.

All types of dams are equal in cost at zero height, departing from each other with increase in height.

The Eastwood multiple-arched dam leaves all competitors in economy and is adapted to a wider range of height than any other type. There are very few sites where any dam is safe that an Eastwood multiple-arched dam cannot be made safer. There are few places where it is possible to build any other type as strong and as cheaply. This dam can be built with high safety factors more cheaply than even an earth dam.

ELECTRIC FLOATS AT PORTLAND.

A parade of electric floats emblematic of the history and progress of Oregon was the feature of this year's Rose Festival and also of the electrical parade on the night of the Fourth of July under the auspices of the Portland Ad Club. Because of their electrical interest the accompanying pictures were taken especially for this journal through the courtesy of the Portland Railway, Light & Power Company.

The cars were historically arranged showing the early Indian life, the discovery of the Columbia River, the Hudson Bay traders, and the coming of Lewis and Clark. Life on the plains, harvest time, and blazing the trail of steel are more recent, while contemporary progress is depicted by the electric power plant, "the gift of many waters," the royal salmon, the giant fir, the beautiful apple blossoms and the fragrant roses. These, together with the new commerce attendant upon the Panama Canal, pictorially presented the story of the building of this great empire.

The floats were the product of six months' hard work by twenty men, representing a cost of \$25,000. The flat cars were donated by the Portland Railway, Light & Power Company. In addition, there were six band cars, of which three were carried on electric locomotives furnished by the Pacific Bridge Company.

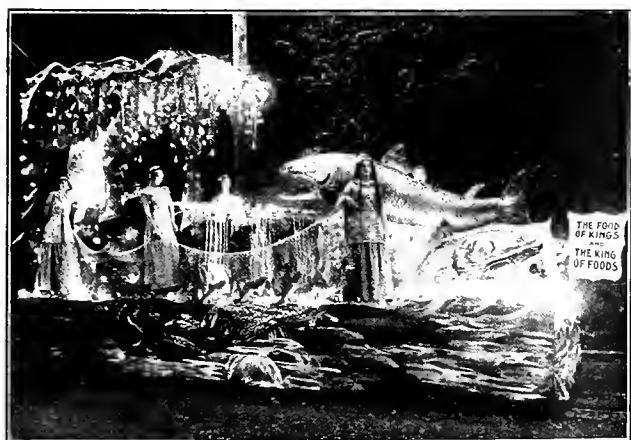
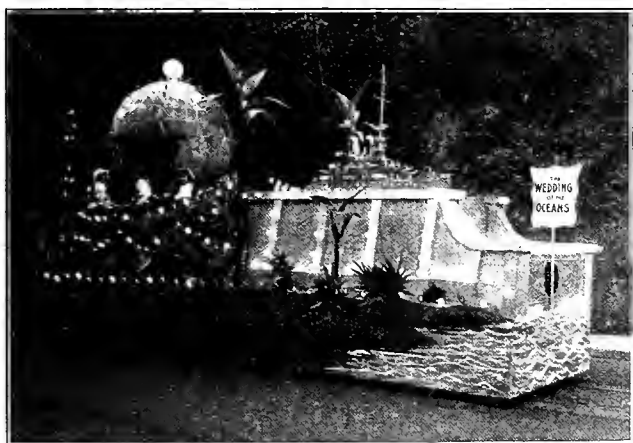
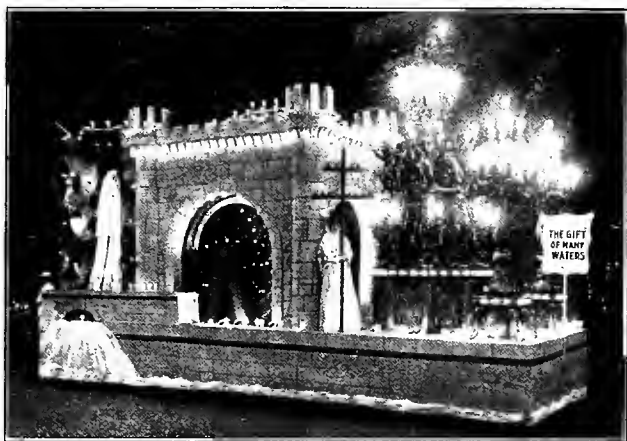
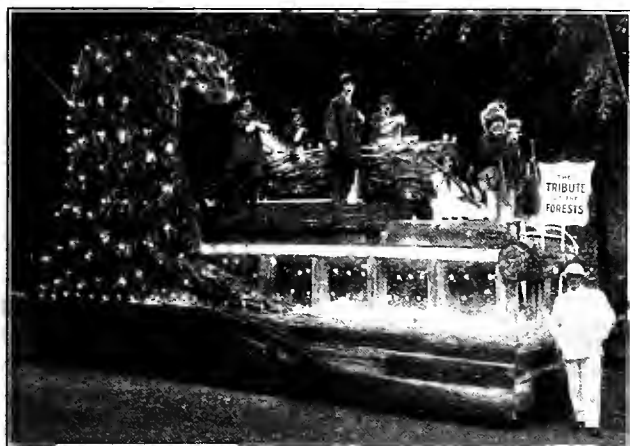
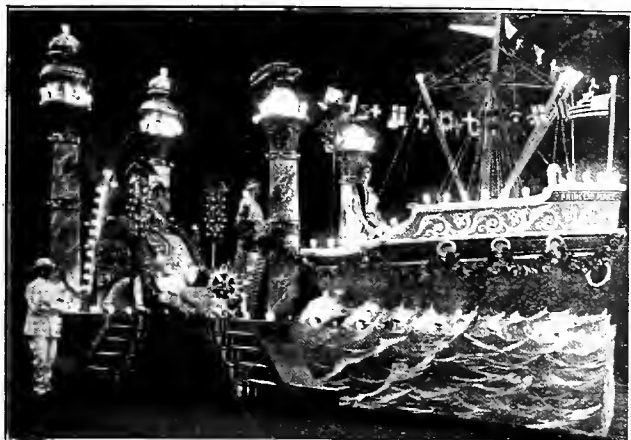
The cars were propelled at slow speed by their own motors and many mechanical features on the floats were motor-operated. All of the 20,000 incandescent lamps were special series lamps rated at 120 volts and using trolley current. It is estimated that the power to operate the floats cost \$500 per night.

The Portland Ad Club showed a striking float of optimism, prosperity and confidence burning the "psychological boo-ga-boo."

CASH INVESTMENT OF THE RAILWAYS DURING SIX YEARS.

During the six fiscal years 1908 to 1913, inclusive, the steam railways of the United States of Class I invested in their road and equipment cash to the amount of \$4,010,385,303. Railways of Class I, so designated by the Interstate Commerce Commission, are those with annual operating revenues of over \$1,000,000. They include about 90 per cent of the mileage, receive more than 96 per cent of the revenues, and handle more than 98 per cent of the traffic.

This cash investment of the operating railways of Class I of the Eastern District during the six years was greater than the amount of capital securities issued by them during this period, and was 19.9 per cent of the aggregate of their capital securities outstanding June 30, 1913; of the railways of the same class of the Southern District it was 21.1 per cent, and of the railways of the same class of the Western District it was 23.2 per cent of the aggregate of their capital securities outstanding June 30, 1913. That is, the cash actually expended by these railways during the last six years upon their properties used in transportation amounts to more than one-fifth of their total capitalization at the close of the last fiscal year. This is at the rate of \$668,397,551 per year.



Electrical Floats at Portland.

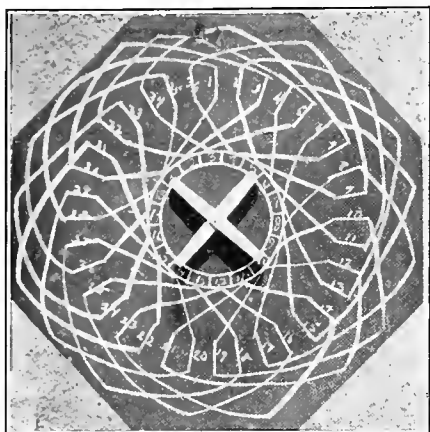
ELECTRICAL DEMONSTRATIONS.

BY E. L. ARNOLD AND D. B. MUNROE.

(These demonstrations for class room work were presented as a thesis to the University of Southern California for the degree of Bachelor of Science in Electrical Engineering, and delivered as a paper at the last meeting of the Los Angeles Section, A.I.E.E., by the authors.—The Editor.)

Proposition IV—Commutation Model.

The object of this proposition was to illustrate the theory of commutation. This was accomplished by means of a black wooden disk on one side of which was drawn the conventional diagram of a thirty-six



Commutation Model.

inductor drum wound armature and an eighteen segment commutator while on the reverse side was the Gramme ring winding with an eighteen segment commutator.

As this was painted on black board any desired armature winding could be placed on the drum armature and its currents checked out and the feasibility

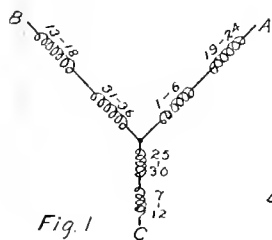


Fig. 1.

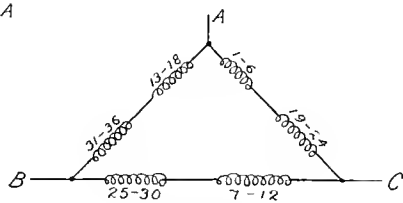


Fig. 3.

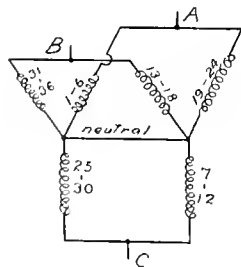


Fig. 2.

Fig. 1. Series Y.
Fig. 2. Parallel Y.

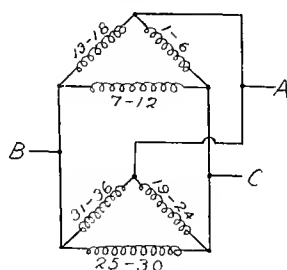


Fig. 4.

Fig. 3. Series Delta.
Fig. 4. Parallel Delta.

of the winding determined. By means of rocker arms at 90 degrees apart the brushes were represented and were brought to bear on the commutator segments. By moving the arms the brushes can be made to bear on different commutator bars and then the difficulties arising thereby could readily be seen and the effects of shifting brushes either way was determined.

The various windings suggested in Proposition I can be used to good advantage and the advantages of one over the other readily seen and currents traced through and showing the functions of the brushes on a generator.

Also by this blackboard method the connections necessary for an alternating current winding can be worked out and discussed, and after they have been traced through the results can be applied to a motor in the laboratory which also has 36 inductors whose ends have been brought out to a terminal board and so arranged that any desired combination of inductors could be obtained.

The following four windings were figured out using a three-phase circuit on the model and then tested on the above mentioned motor.

It was evident that this motor was designed to apply full voltage across each coil of six inductors, which necessitated the use of the two parallel windings, for the series combination in which half voltage was applied gave poor starting torque and load conditions below the parallel connections.

The accompanying diagrams indicate the combinations of coil used in the four windings.

MEXICAN TURBINE-RUNNER CANNON.

Advices have just been received by the Pelton Water Wheel Company that some large phosphor bronze Pelton-Francis turbine runners operating in a Mexican hydroelectric plant were put to rather a novel use by the rebels. In a raid by one of General Obregon's columns the power plant was partially demolished and the turbines wrecked. The raiders took the bronze runners and reduced them to small fragments, after which they were melted and used in casting two small muzzle-loading cannon, which were subsequently effectively used by the Constitutionalists in their operations around San Blas, Tepec and other points.

The cannon were each mounted in a gun-carriage consisting of a pair of old ox-cart wheels, the whole outfit being arranged for ready dismounting and sectionalization for muleback transportation. At the initial trials the gunner (a former power-house operator) recalling evidently that the turbines carried a considerable overload during the peaks, worked on the theory that the cannon would also stand an overload of powder, with the result that the gun-carriage was wrecked and a pack train stampeded amid general cries of "Caramba!" Possibly the "high specific speed" characteristics of these turbine runners may partially account for their lively actions in their new sphere of usefulness.

The magnetic quality of iron melted in vacuo is superior to iron melted in air, because it loses from 50 to 90 per cent of its original carbon content. In experiments at the University of Illinois a permeability of 19,000 at a flux density of 9,500 gauss was recently obtained with electrolytic iron melted in vacuo. The average hysteresis loss is less than half of that found in the best grades of commercial transformer iron. Its low specific electrical resistance of 9.96 microhms can be remedied by the addition of silicon or aluminum, whose alloys increase the resistance without materially affecting the magnetic quality.

HYDROELECTRIC COST DATA.

BY J. D. ROSS.

The following table of costs has been compiled from the records of the Seattle Lighting Department and aims to show in detail the cost of Seattle's municipal plant as it appeared on the books at the end of 1912. The first part of the table gives the total costs of each of the main sub-divisions of the plant and the cost per kilowatt of generator capacity. This capacity is taken as the maximum rating of all the generators on a 40 degree C. temperature rise. The table is not intended to show the cost of the average hydroelectric plant, and it would not represent exactly the cost of reproducing the present plant. The fact that the plant was started on a small scale and extended to meet the need as funds were available makes considerable difference in the expense of its construction. The total of \$62 per horsepower for the generating system is, however, a very reasonable figure for such a system in this part of the country.

To get unit costs, each item of the plant is assigned a capacity in kilowatts. To simplify comparison, the capacity of the dam, penstock and generating units are given in terms of output at the generator. For instance, the smaller penstock will supply water to generate 3600 kilowatts at the switchboard, and it is estimated that the dam will give sufficient storage to care for a generating station of 9000 kilowatts capacity, having the same character of loading as the present system, in any season. The transmission lines are rated on a basis of 10 per cent power loss with 90 per cent power factor at the substation. The substations are rated according to their transformer capacity at normal load, while various pieces of apparatus in the station are given a normal rating. The distributing lines are rated on a basis of actual capacity with good regulation. Installations are rated according to connected load. In the cluster lighting system the cost of the various items is computed on a basis of costs per pole.

The tables of unit costs for wires in place, poles, services and installations are compiled from the records of the actual cost of doing this work by the department. In all cases where overhead charges are not included in the unit costs, 10 per cent should be added to cover these charges.

General Costs.		Cost per kw. on basis of 15,500 kw. Capacity
Division of Plant.	Cost.	
Wood Crib Dam.....	\$ 61,863.80	\$ 3.99
Penstocks	299,471.59	19.32
Power Station	354,387.44	22.86
Transmission Lines	232,629.62	15.01
City substations	242,096.21	15.62
Lake Union Auxiliary Station.....	95,550.32	6.16
Total Generating System	\$1,285,998.98	\$ 82.96
Commercial Distributing Circuits, with poles	\$ 966,906.87	\$ 62.38
Installations, Meters, Service, Lamps, Motors, etc.	616,416.25	39.77
Series Street Lighting System.....	358,049.33	23.10
Cluster Street Lighting System.....	398,165.94	25.69
Underground Distributing System.....	125,797.73	8.12
Storeroom	774.44	.05
Total of Distributing System.....	\$2,466,110.56	\$159.11
Total cost of plant, exclusive of new masonry dam, now under construc- tion	\$3,752,109.54	\$242.07
Cost per h.p. at generators, on a basis of 20,800 h.p. ca- pacity:		
Generating System	\$ 61.83	
Distributing System	118.56	
Total System	\$180.39	

Division of Plant.	Detail Costs.		Unit Cost (per kw.)
	Capacity kw.	Cost.	
Wood Crib Dam.....	9,000	\$ 61,863.80	\$ 6.87
Penstocks, combined.....	11,000	299,471.59	27.23
No. 1 Penstock, complete.....	3,600	84,475.79	23.40
15,407 ft. 49 in. wood stave pipe, complete in place.....		33,044.16	
1,061 ft. 48 in. steel pipe, 308,000 lbs., complete.....		14,386.01	
16,468 lineal ft. grading and filling		37,045.62	
No. 2 Penstock, complete.....	7,400	214,995.80	29.00
15,865 ft. 68 in. wood stave pipe, complete		131,561.78	
1992 ft. 48 in. steel pipe, with Y connection, valves and cross-over to smaller pipe.....		19,587.27	
Two 36 in. standpipes, 65 and 70 ft. high		2,316.31	
16,816 lineal ft. grading and filling		61,530.44	
Cedar Falls Generating Station, total	13,500	354,387.44	26.30
Power House Buildings, Station, Switch House, Trans- former House and Freight Shed		47,829.77	
Employees' Cottages		10,386.82	
Two 8000 h.p. turbines with hydraulic valves, governors and relief valves, complete in place	10,000	53,296.55	5.33
Two 2400 h.p. Pelton wheels, with valves and governors, complete	3,500	28,200.00	8.05
Two 5000 kw. generators, com- plete in place	10,000	39,422.00	3.94
Two 1750 kw. generators, complete in place.....	3,500	23,782.00	6.50
Two 75 kw. exciters, with Pelton wheels and governor	150	5,383.00	35.80
One 150 kw. exciter with Gi- rard wheel	150	4,500.00	30.00
Switchboard, complete	13,500	11,042.45	.82
2300 volt wiring, busses and switches	13,500	30,348.29	2.25
Nine 1500 kw. 60,000 volt transformers, in place.....	13,500	74,649.17	5.54
60,000 volt wiring and switches	40,000	25,547.79	.64
Transmission Lines, total	40,000	232,629.62	5.82
No. 1 transmission line, total.....	13,000	119,012.72	9.18
Right of way for both lines.....		40,490.39	
1515 poles and arms, in place.....		21,584.04	
4605 insulators		19,938.29	
117,500 lbs. No. 2 copper wire.....		28,480.24	
Two telephone lines: one of No. 10 copper, one of No. 14 iron, on power line poles, com- plete		8,519.76	
No. 2 transmission line.....	27,000	112,889.99	4.18
732 poles, with arms, in place.....		21,943.69	
2256 insulators, in place.....		7,699.37	
374,700 lb. No. 4-0 stranded copper wire		78,044.53	
Telephone line 3/16 in. plov steel cable, on power line poles		4,475.49	
Linemen's cottages, incomplete.....		736.91	
City Substations, total.....	12,000	242,096.21	20.17
Main substation, Seventh avenue and Yesler Way, total	12,000	216,063.89	18.00
Substation building		30,081.26	
60,000 volt switches and wiring	40,000	7,250.00	.18
Eight 1500 kw. 50,000 volt transformers in place.....	12,000	56,350.00	4.69
15,000 volt and 2500 volt wiring and switches	12,000	46,155.83	3.85
Station switchboard	12,000	17,500.00	1.46
Twelve 2500 volt feeder regu- lators on commercial circuits	600	14,750.00	24.58
500 kw. direct current motor generator set	500	15,500.00	31.00
Twelve 100-lamp constant cur- rent transformers with switches and wiring.....	720	15,250.00	21.20
500 ampere hour 500 volt stor- age battery	500	11,576.80	23.15
60 kw. motor generator.....	60	1,650.00	27.50
Four outlying substations.....	3,300	26,032.32	7.90
Seven 15,000 to 2500 volt trans- formers, total 3300 kw.....	3,300	15,582.26	4.73
Five constant current trans- formers, complete	300	4,925.00	16.42
Three 2500 volt feeder regu- lators	150	3,330.00	22.20
Station wiring and switches.....	3,300	545.06	.16
Four buildings, corrugated iron.....		1,650.00	
Lake Union Auxiliary Station.....	1,900	95,550.32	50.30
Building complete	1,900	10,044.45	5.27
2500 h.p. Pelton-Francis water wheel with governor and valves complete.....	1,900	8,914.82	4.80
1500 kw. 2500 volt alternator with exciter, complete	1,900	10,675.85	5.62
Station, wiring, switches and switchboard	1,900	8,150.25	4.30
3400 ft. 40 in. steel penstock, complete, 400,000 lbs.	1,900	41,456.51	21.80
Special tie-line, 2500 volt two- phase, 819,000 c.m. alumi- num, complete		16,308.44	
Commercial Circuits, including Commercial Poles, total		966,906.87	
15,000 volt distributing system, total	6,000	69,874.17	11.65
122 miles bare copper wire, No. 2 to 4-0, in place, 142,- 400 lbs.		36,136.08	

Division of Plant.	Capacity kw.	Cost.	Unit-Cost (per kw.)
15,000 volt insulators and pins.....		4,377.12	
25 transformers, 25 kw. to 600 kw., total 2950 kw., complete in place.....	2,950	11,537.89	3.92
37 out-door disconnecting switches, 1 to 5 pole.....		4,630.39	
555 poles, 3.4 per cent of all poles, in place.....		13,192.69	
2500 volt distributing system.....	10,600	427,793.01	42.78
584 miles weatherproof cop- per wire, No. 6 to 350,000 c.m., in place.....		181,917.18	
2500 volt insulators and pins.....		22,602.85	
1256 transformers, 2 kw. to 50 kw., total 10,364 kw., in place.....	10,364	123,778.12	11.83
4183 poles, 25.8 per cent of all poles, in place.....		99,494.86	
120-240 volt secondary system.....	10,364	429,453.59	41.40
1310.5 miles weatherproof cop- per wire, No. 6 to 4-0, in place.....		230,408.15	
Insulators and pins.....		41,008.02	
poles, in place.....		158,037.42	
Direct Current Circuits.....	1,000	39,786.10	39.78
34 miles weatherproof copper wire, No. 1 to 350,000 c.m., in place.....		31,361.38	
Insulators and pins.....		4,302.00	
173 poles, 1.17 per cent of all poles, in place.....		4,122.72	
Installations, Light and Power, total.....	23,225	616,416.25	26.50
Business Light Installations.....	3,425	61,027.17	17.85
2077 services.....		25,116.50	
2077 meters in place.....		25,806.32	
50,588 carbon lamps.....		7,527.68	
94 arc lamps, complete.....		2,576.67	
Residence Light Installations.....	13,600	507,204.36	37.30
23,100 services.....		165,711.06	
23,100 meters.....		298,154.16	
303,063 gem carbon lamps, 4,536,000 c.p.....		43,339.14	
Power Installations.....	6,200	47,435.59	7.65
455 services.....		10,571.10	
910 meters.....		19,552.30	
81 motors, 1/2 to 25 h.p., total 499 1/2 h.p. in place.....		17,132.19	
Domestic Power Installations.....	72	749.13	10.40
19 services.....		388.32	
19 meters.....		360.81	
Series Street Lighting System.....		358,049.33	
645 miles No. 6 weatherproof copper wire in place.....		128,469.80	
Insulators.....		31,100.00	
929 arc lamps, complete, in place.....		37,387.33	
5876 50 w. tungsten series in- candescent lamps with fix- tures, in place.....		51,203.12	
4622 poles, 2-7 of all poles in place.....		109,939.08	
		Cost.	Cost per Pole
Cluster Lighting System.....		\$398,165.94	\$235.50
1,692 iron cluster poles.....		61,322.50	36.25
1,692 sets globes, lamps, wiring.....		22,767.69	13.45
1,126 pole-base transformers, 250 w.....		9,639.54	5.70
57,081 ft. lead covered 7500 volt cable.....		27,701.98	16.35
159,766 ft. secondary cable.....		41,814.45	24.70
29 oil switches.....		1,663.00	1.00
69 manhole transformers, 810 kw.....		11,747.85	6.95
292,789 ft. black iron conduit.....		84,638.22	50.00
151,764 ft. fibre pipe in concrete.....		25,119.11	14.85
89 manholes.....		16,850.39	9.95
873 handholes.....		17,368.90	10.25
124 junction boxes.....		2,689.30	1.60
283 cu. yd. concrete.....		2,202.83	1.30
21,766 cu. yd. excavation.....		16,998.21	10.00
13,583 sq. yd. cement sidewalk relaying.....		14,354.88	8.50
63,000 board feet sidewalk relaying.....		662.57	.40
3,771 sq. yd. repaving.....		11,051.19	6.55
30,000 board feet planking street.....		255.48	.15
1,692 sets bolts and anchor plates.....		1,579.72	.95
Clearing, fixed estimates and incidentals.....		27,743.13	16.40
Underground Conduit System, Commercial.....		125,797.73	
102 manholes.....		24,887.43	
62 handholes.....		3,802.24	
249,979 ft. vitrified clay duct.....		60,381.49	
120,000 ft. black iron conduit.....		36,727.57	
Storeroom.....		774.44	

Unit Cost of Distributing System.

On basis of 17c Copper.
Allowing 5 per cent for sag and corners.
Does not include Overhead Charges.

2500 Volt Primaries, Triple Braid—Weatherproof.

Size and No. of Wire.	Weight per 1,000 ft.	Wire.	Labor.	Insu- lators.	Total.
Two No. 6.....	224	\$ 40.00	\$4.50	\$1.10	\$ 45.60
Two No. 4.....	328	58.55	4.70	1.10	64.35
Two No. 2.....	520	92.80	5.50	1.20	99.50
Two No. 1.....	632	112.80	6.00	1.20	120.00
Two No. 0.....	814	145.30	7.60	1.20	154.10
Two No. 00.....	1,004	179.20	8.10	1.40	188.75
Two No. 3-0.....	1,258	224.55	8.60	1.50	234.65
Two No. 4-0.....	1,534	273.80	9.40	1.70	284.90
Two 350,000 C.M. 111	2,690	480.15	44.00	2.00	526.15

120-240 Volt Secondaries.

One No. 6.....	112	20.00	3.40	.45	23.85
Two No. 6.....	224	40.00	4.40	.90	45.30
Three No. 6.....	336	59.95	4.90	1.35	66.20
One No. 4.....	164	29.30	3.60	.45	33.35
One No. 4 and one No. 6.....	276	49.25	4.50	1.35	55.10
Two No. 4.....	328	58.55	4.60	.90	64.05
Two No. 4 and one No. 6.....	440	78.55	5.20	1.35	85.10
Two No. 4 and one No. 4.....	492	87.80	5.40	1.35	94.55
Two No. 3 and one No. 4.....	562	100.35	6.00	1.45	107.80
Two No. 2 and one No. 4.....	634	122.10	6.50	1.50	130.05
Two No. 2 and one No. 2.....	780	139.25	7.05	1.50	147.80
Two No. 1 and one No. 6.....	744	132.80	6.80	1.45	141.05
Two No. 1 and one No. 4.....	796	142.05	7.00	1.45	150.50
Two No. 1 and one No. 1.....	948	169.20	7.80	1.50	178.50
Two No. 0 and one No. 2.....	1,074	191.75	8.15	1.50	202.40
Two No. 0 and one No. 4.....	978	174.55	7.20	1.45	183.20
Two No. 0 and one No. 1.....	1,130	201.70	8.40	1.50	212.60
Two No. 00.....	1,004	179.20	8.10	1.20	188.50
Two No. 00 and one No. 4.....	1,168	208.50	9.20	1.65	219.35
Two No. 00 and one No. 1.....	1,320	235.60	10.00	1.70	247.30
Two No. 4-0 and one No. 1.....	1,850	330.20	11.40	2.10	343.70
Two No. 4-0 and one No. 0.....	1,941	346.50	12.20	2.10	360.80
Two No. 4-0 and one No. 00.....	2,036	363.40	12.50	2.20	378.10

250-500 Volt Direct Current System.

Size and Number of Wire.	Weight per 1000 ft.	Wire.	Labor.	Insu- lators.	Total
Two No. 1.....	328	\$ 58.55	\$4.60	\$0.90	\$ 64.05
One No. 2.....	260	46.40	4.00	.50	50.90
Two No. 2.....	520	92.80	5.50	1.00	99.30
Three No. 2.....	780	139.20	7.05	1.50	147.75
Two No. 1.....	632	112.80	6.00	1.00	119.80
One No. 0 and one No. 4.....	571	101.90	6.10	1.00	109.00
Two No. 0.....	814	145.30	7.60	1.00	153.90
Three No. 0.....	1,221	217.95	10.20	1.50	229.65
One No. 00 and one No. 0.....	909	162.25	7.10	1.10	170.45
Two No. 00.....	1,004	179.20	8.10	1.20	188.50
Three No. 00.....	1,506	268.80	11.10	1.80	281.70
One No. 4-0.....	767	136.90	5.90	.80	143.60
One No. 4-0 and one No. 00.....	1,269	226.50	8.75	1.40	236.65
Two No. 4-0.....	1,534	273.80	9.40	1.60	284.80
Two No. 4-0 and one No. 1.....	1,850	330.20	11.40	2.10	343.70
Two No. 4-0 and one No. 00.....	2,036	363.40	12.50	2.20	378.10
Three No. 4-0.....	2,301	410.75	13.20	2.40	426.35
Two 350,000 C.M.....	2,690	480.15	42.00	2.00	524.15
Two 350,000 C.M. and one No. 4-0.....	3,457	617.05	46.40	2.80	666.25
One 400,000 C.M.....	1,553	277.20	18.00	1.00	296.20
Two 750,000 C. M.....	5,644	1,007.45	48.00	2.20	1,057.65

Series Street Circuits.

Wire.	Weight per 1000 ft.	Wire.	Labor.	Insulators.	Total.
One No. 6.....	112	\$20.00	\$3.40	\$0.55	\$23.95
Two No. 6.....	224	40.00	4.40	1.10	45.50
15,000 Volt System—Bare Wire.					
One No. 2.....	201	\$ 35.90	\$ 5.10	\$ 2.10	\$ 43.10
Two No. 2.....	402	71.80	6.90	4.20	82.90
Three No. 2.....	603	107.65	8.50	6.30	122.45
Four No. 2.....	804	143.50	10.50	8.40	162.40
Five No. 2.....	1,005	179.40	12.20	10.50	202.10
Four No. 1.....	1,014	181.00	12.50	8.40	201.90
Four No. 0.....	1,278	228.10	14.50	9.00	251.60
Four No. 00.....	1,612	287.75	16.50	10.00	314.25

Wage Schedule for Line Work 1912—Eight Hour Day.

Line foreman.....	\$4.75
Lineman.....	4.20
Groundman.....	2.75
Pole foreman.....	3.25
Poleman.....	2.75
Teamster.....	2.75
Teamster and team.....	5.00
Laborer.....	2.75

Cost of Insulators.

Type.	Where Used.	Largest Wire.	Voltage.	Cost Each
Pittsburg, 196.....	Trans. lines.....	No. 4-0.....	60,000	\$1.275
Pittsburg, 71.....	15,000-V. lines.....	No. 4-0.....	15,000	.30
33 Brown.....	Primaries.....	No. 0.....	2,500	.04685
42 Brown.....	Primaries.....	350,000 C. M.	2,500	.04960
Street Railway.....	D. C. and Secondaries.....	No. 0.....	250-125	.0370
Hemingray Cable.....	D. C. and Secondaries.....	750,000 C. M.	500-125	.08281
33 Drab.....	Street Circuits.....	No. 6.....	3,500	.048685

Cost of Poles—1912 Average.

Includes Overhead Charges.

Length Feet.	Fore- man.	Pole- man.	Line- man.	Team.	Total	Pole Cost.	Total Cost. in place.
40	\$0.65	\$4.05	....	\$1.87	\$ 6.57	\$ 5.17	\$11.74
45	.67	4.52	....	1.55	6.14	6.11	12.85
50	.81	4.66	.31	2.07	7.85	6.77	14.62
55	.92	5.94	.36	2.47	9.69	8.03	17.72
60	1.44	5.96	1.31	2.56	11.27	9.46	20.73
65	1.34	7.94	.72	4.19	14.19	10.28	24.47
70	1.52	8.90	1.09	3.55	15.06	13.48	28.54

Cost of Installations, 1913.

Installations include service from pole to building, meter, lamps supplied by the Department. To these costs 10 per cent should be added for superintendence and tools.

	Pay- roll.	Material*	Miscella- neous.	Total.
Business installations.....	\$2,576	\$14,624	\$0.375	\$17,575
Residence installations.....	2,018	11,116	0.288	13,422
Power installations.....	3,581	26,873	0.425	30,880
Domestic Power installations.....	5,181	26,861	0.617	32,660

*Includes meters and lamps.

EXPERIMENTS WITH SUSTAINED HIGH-FREQUENCY HIGH-VOLTAGE.

BY J. C. CLARK.

(This is the second of a series of articles concerning the marvelous experiments with high voltage at high frequency which are being conducted at Stanford University under the direction of Prof. Harris J. Ryan, assisted by Prof. Clark. Subsequent articles written by Prof. Ryan will take up the high potentiometer and its application in determining the voltage duty of the units in suspension type insulators. The articles are not only of intense theoretical interest but of great practical value in determining why insulators fail.—The Editor.)

A previous article by the writer described the apparatus developed in the Electrical Engineering Laboratory at Stanford University for the generation of sustained high-frequency high-voltage. It is the purpose of the present article to describe the principal experimental work which has been performed with this apparatus.

It is desirable to acquaint the reader with some of the more striking properties of the sustained high-frequency voltage, and current, insofar as these properties are dependent on the frequency. It is necessary to remember throughout that the frequencies used in these experiments range from about 75,000 to 615,000 cycles per second; or, roughly, from 1000 to 10,000 times the frequency of 60 cycles commonly used in transmission. It is difficult, even for one daily engaged in work with high-frequency apparatus, to grasp the entire significance of this enormous increase in frequency, and to form any adequate conception of the manner in which certain low-frequency effects are intensified thereby.

It is a well known fact that a given condenser will take, at a given alternating voltage, a current which is directly proportional to the frequency. At ordinary commercial frequencies, this fact is of little practical significance; and it is only in the cases where the actual capacity of the condenser is great, as in very long transmission lines, or in long underground cables, that the charging current becomes a factor with which serious reckoning must be made. However, at the high frequencies developed in these experiments, even a very small capacity takes a relatively large charging current. For example, a pair of seven inch copper spheres, separated 3 inches, takes at 100,000 volts, r.m.s., and 100,000 cycles, a charging current of approximately one ampere. In the use of the sphere-gap voltmeter on high frequency this relatively enormous charging current to the spheres prohibited the use of carborundum rods as resistance to limit the current on gap discharge; owing to the fact that the large amount of power consumed in the rods (enough to heat two of them in series to a bright red) prevented satisfactory operation of the arc generator. Accordingly fine wire fuses, guarded to prevent corona, were substituted for the rods as a means of limiting the current on gap discharge. Masses of wood, or other hydrocarbonous material, placed in such a position as to concentrate the charging current flowing between parts of the circuit operating at considerable potential difference, often exhibit disagreeable effects, such as charring and burning of the material. Whenever such material must be used as insulation, it is necessary to exercise the greatest care in designing the parts of conductors coming in

contact with the material in such a manner that no undue concentration of the charging current at the contact is permitted.

It was apparent at the very beginning of the experiments that the high frequency voltage possessed remarkable corona developing properties. It is not to be inferred from this that the start of corona occurs at any lower voltage with high-frequency than with low-frequency, but that the importance of the so-called "local" corona is tremendously enhanced with the great increase in frequency. The result is that any corona developing conductor is capable of exercising exceedingly destructive effects when it is allowed to play the corona upon insulation of any kind. The sequence of effects is apparently: (1) ionization, (2) heating, (3) destruction. It should be noted, however, that here as in handling low-frequency high-voltage local corona formation may be prevented by proper dimensioning of parts. For example, there is complete absence of corona formation upon the spheres of a sphere-gap prior to discharge, when it is used with gaps not exceeding the diameter of the spheres.

The high frequency voltage exhibits an ability to jump very large gaps between blunt points. Fig. 1 is

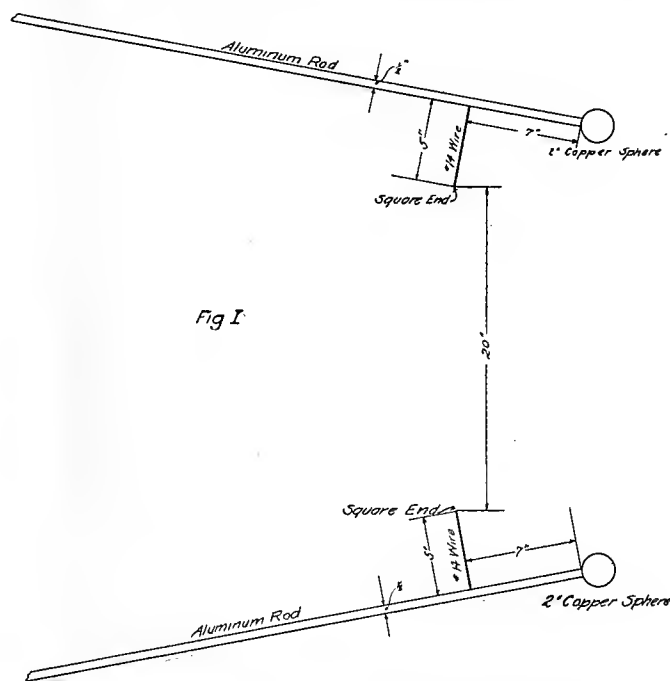


Fig. 1. Apparatus Demonstrating Ability of High Frequency Voltage to Jump Large Gaps Between Blunt Points.

a drawing showing the arrangement of apparatus in a test to demonstrate this fact. To jump this 20 inch gap with high frequency requires only 80,000 volts r.m.s., while to jump the same gap at 60 cycles would probably require over 200,000 volts. It should be noted that the arrangement here is such as to shield the projecting gap terminals somewhat, and the effect of such an arrangement is, of course, to increase the voltage required for the given gap beyond that which would be required if the connections were brought to the terminals in the most favorable way: i. e., in line with the terminals.

It is found that coronas may be started in the following manner upon a conductor the dimensions of which are such as normally to render the conductor

corona-free. When any bulky object is brought up close to the conductor, an arc will jump to the object, and continue to run, whether or not the latter is connected to the opposite side of the circuit. This is apparently due, in the case of a non-conductor, to the concentration of electric field through the object owing to its possessing greater specific inductive capacity than the surrounding atmosphere. In the case of a conductor, it is evidently due simply to the increased area offered for the circulation of charging current between the two sides of the circuit. When the bulky object is withdrawn, the arc is, of course, broken; but a vigorous corona brush generally remains in place of the arc. With the breath one may

corona display over a very limited area. After this has persisted for about five seconds, a conducting puncture is formed between the points, and the path of the subsequent current through the glass glows at white heat. It is difficult to maintain the arc-generator in operation after the breakdown has occurred owing to the disturbance of the oscillatory circuit due to the short circuiting of the inductance by the hot conducting glass. Upon drawing one or both electrodes away from the specimen in order to lengthen the arc, and thus remove the short circuit from the inductance, the action of the oscillatory circuit is restored, and one may then play a long, hot arc upon the test specimen.

A particularly interesting characteristic of the high-frequency high-voltage is its propensity for puncturing sheet insulating materials such as plate glass in the atmosphere rather than to flash over the surfaces and around the edges. Those who are familiar with the manner in which 60 cycle high voltage produces flashovers in preference to puncture are especially impressed with the opposite tendency of the high-frequency high-voltage. For example, a piece of plate glass $\frac{3}{8}$ in. thick may easily be punctured at a distance of $1\frac{1}{2}$ in. from the edge, whereas this is possible with low-frequency voltage only when the test specimen is immersed in oil. This tendency is further illustrated by Fig. 2 which shows the mounting of a porcelain knob for test; 20,000 volts r.m.s., at 100,000 cycles will form a puncture directly through the porcelain with almost complete absence of flash over between terminals although the flash over distance is extremely small.

The process of puncturing a piece of electrical porcelain is similar to that of puncturing glass, except that porcelain is considerably the tougher material. This superior toughness of porcelain is especially manifest when the puncture is practically completed, as it often shows little evidence when cold that puncture has occurred. Often it requires the re-application of the high-frequency voltage to disclose the fact that the porcelain has already been punctured. Upon this re-application, however, the old puncture immediately manifests itself as a glowing core of molten conducting material.

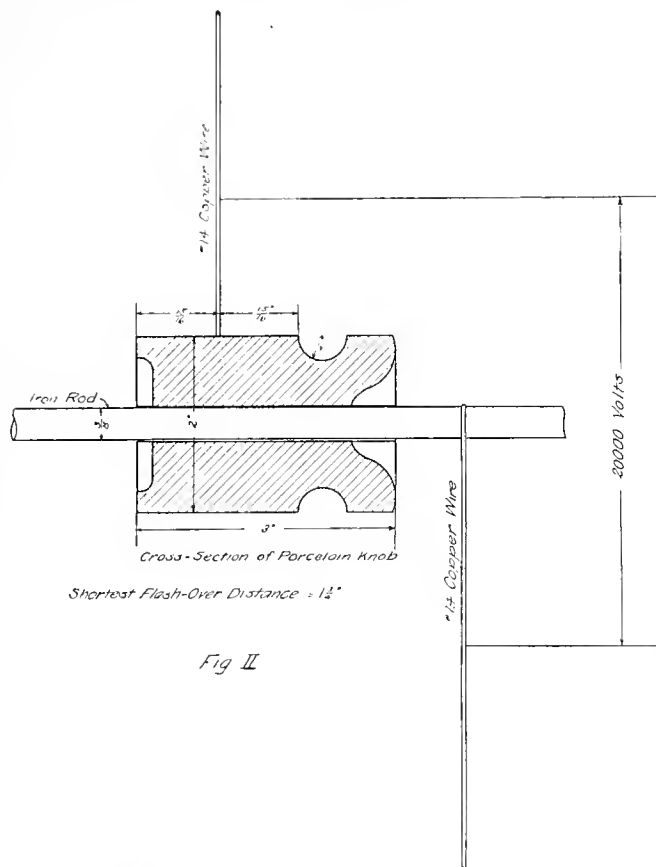


Fig. 2. Mounting of Porcelain Knob for Puncture Test.

blow this brush along the conductors, and frequently it may readily be blown into a region which is especially well adapted by its dimensions or arrangement to withstand the start of corona.

A large part of the work thus far done with the equipment has consisted in making qualitative observations of the effect of applying high-frequency high-voltage to samples of glass or porcelain. All available samples of these materials are very easily and quickly punctured, and sometimes shattered, when blunt metallic terminals carrying the high-frequency voltage are placed opposite each other, and resting upon the surface of the sample.

When approximately 20,000 volts, r.m.s., at 100,000 cycles are applied to plate glass $\frac{3}{8}$ in. thick by means of blunt points resting against the surfaces opposite each other, the first effect observed is merely the spread of the charging current taken by the glass away from the contact points in the form of a vivid

The constitutionality of the Idaho public utilities law has just been sustained by the Supreme Court of Idaho. The public service commission has issued orders shutting the Idaho Power & Light Company out of Twin Falls and the Beaver River Company out of Pocatello for the reason that they have not secured from the commission certificates of necessity and convenience as provided by law. The Great Shoshone & Twin Falls Water Power Company was already in Twin Falls, and the Southern Idaho Water Power Company was in Pocatello. The new applicants promised lower rates and better service. The effect of the decision is to give the commission absolute power in matters of this kind. The opinion was written by Justice Sullivan and concurred in by Judge E. A. Walters of the fourth district, sitting for Justice Stewart, who is ill. Chief Justice Ailshie dissented from the majority opinion.

P. P. I. E. MACHINERY EXHIBITS

THE DIESEL ENGINE.

The center of the Palace of Machinery at the Panama-Pacific International Exposition will be occupied by a 500 brake horsepower Diesel engine built by the Busch-Sulzer Bros.-Diesel Engine Company, St. Louis, the pioneers of the Diesel engine in America. This was the first exhibit to be installed, ground having been broken and the first pile driven May 27th with much ceremony; engineers and city, state, federal and exposition officials in attendance.

The engine will be direct connected to a Westinghouse type "Q" direct current generator, driven at 200 r.p.m. and developing 335 kw. at 250 volts. This generator is characterized by perfect commutation with brushes remaining in a fixed position from no load to heavy overload, excellent ventilation and low temperature rise and minimum weight. It will be a working exhibit, valued at \$70,000, which will "tie in" with the regular electrical load of the Exposition and do its share supplying that which has become so vital a factor in the life of these colossal expositions—electricity.

The exhibit will afford every opportunity to study the engine which epitomizes the accumulated experience of fifteen years of Diesel building. The exhibit will be surrounded with charts illustrating the dominant features of fuel consumption very nearly in direct proportion to load—the engine's unique ability to maintain a fuel economy, which, anywhere between a load equal to half the capacity of the smallest unit up to the full capacity of the plant, assures a thermal efficiency equal to operation at full load at all times. The exhibit will be supplemented with photographs of Diesel installations in twenty-six states showing types, methods of operation, and diversity of application. Every endeavor to make it intelligible and worth while to engineer and layman alike will be made.

There are two distinct fields in which the Diesel engine excels; first, for auxiliary or stand-by service; second, for continual operation with a constant and full load. As an auxiliary or emergency unit the engine cuts out all "stand-by losses," wasted fuel in keeping up steam and the extra attendance required for this purpose. A twist of the wrist starts the engine, and full load may be pulled from the start. The engine feeds fuel to itself automatically, and there is no labor incident to its operation.

For a heavy, steady drag its extraordinary saving of fuel and labor is most noticeable. The capital charges are smallest per unit of power developed, and the engine may be depended upon for the longest, severest non-stop runs of six weeks to two months.

The governor of the Diesel engine measures the amount of fuel burnt, just enough being injected on any one stroke to meet the requirements of that particular moment. While this method of governing is largely responsible for fuel consumption in direct proportion to the load, it is only particularly responsible for its notable economy, the main causes being completeness of combustion with almost complete utilization of the resulting heat, and the great cheapness,

abundance and variety of all such oils as are suitable fuel for it.

The temperature of the air change in the cylinder at the end of the compression stroke and just previous to the injection of the fuel is 1000 degrees F. This is a temperature 3 to 8 times that actually required for the ignition of the fuel charge, as fuel oils ignite at temperatures ranging from 120 to about 325 degrees F. This temperature of 1000 degrees, of course, eliminates completely all ignition devices, be they electrical, hot bulb or tube, and assures combustion in an atmosphere which may be described as incandescent, a condition which is ideal and assures perfect combustion, smokeless exhaust and the highest thermal efficiency so far known to the engineering world.

The injection is accomplished gradually by means of an air blast, the fuel entering slowly and burning gradually, giving a smooth crank effort in the same manner as the gradual introduction of steam in the steam engine. Each little atomized particle of oil burns from its surface and is not entirely consumed until the end of the power stroke and the opening of exhaust valves.

It is this principle of combustion which accounts for the magnificent regulation possible with this newest type of prime mover. Whether 2-stroke or 4-stroke, with these exceptions the cycle of the Diesel engine is otherwise very similar to that of the gas or gasoline engine.

For atomizing the fuel by an air blast the Diesel engine requires an air compressor, which, as in the case of the engine to be exhibited by the Busch Company at the Panama-Pacific Exposition, is integral with the engine proper, being actuated by a crank on the main shaft. Each of the four cylinders of this engine is $19\frac{1}{2} \times 24$ in., and each is capable of developing 125 brake horsepower at a speed of 200 revolutions per minute. The base is enclosed, and forced lubrication under a pressure of 30 pounds is provided. The cam shaft for actuating the valves is carried on brackets at the side of cylinder heads and is entirely enclosed. The cylinders, of course, are water jacketed, but so are the exhaust manifold and piping, thus affording an opportunity for the fullest recovery of heat lost to cooling water. Further recovery of lost heat may be provided for by passing the water thus heated through a water jacketed exhaust muffler or "exhaust gas heater economizer" where the same may be raised to near the boiling point. This hot water may then be used in processes of manufacture, in the heating of buildings, and for boiler feed where steam is also required.

In the very best of steam plants but 18 per cent of the total heat value of the fuel consumed is ever converted into power, while average steam plants show an efficiency ranging from 6 per cent to 8 per cent. Contrast this with the 32 to 25 per cent thermal efficiency of the Diesel engine, then add to this an additional 27 per cent recoverable from jacket cooling water and 21 per cent from exhaust gases. Fully 80 per cent of all the fuel consumed in a Diesel engine may be conserved to useful purposes.

PUBLIC POLICY OF PUBLIC UTILITY CORPORATIONS

THE TELEPHONE PROBLEM.

BY D. P. FULLERTON.

(This article constitutes a clear-cut analysis of the difficulties which the telephone company has to meet in educating the public in the proper use of the telephone. How these problems are solved should be of intense interest to all other utilities. The author is division superintendent of the Pacific Telephone & Telegraph Company and presented the paper at the April 24, 1914, meeting of the San Francisco A. I. E. E. Section.—The Editor.)

The difficulties of engineering telephone problems are probably less known and less appreciated, both by the layman and by engineer of other arts, than any other branch of electrical engineering.

Telephone engineering requires the systematic planning of a public service which is operated principally by the untrained public. The engineers engaged in planning other forms of public service know that while the work they are engaged upon is primarily for the benefit of the public, the plant they produce will be operated almost entirely by trained employees. Consequently, if there is any decline in the character of the service rendered, little, if any, of the blame can be traced to the participation of the public in the operation of the service. On the other hand, if the employees operating the service are doing so efficiently, there is little that any one person can do that will render the service inefficient to the public as a whole, or in any way place the burden of responsibility upon the plant of the company supplying the service.

In supplying telephone service this condition is entirely reversed, for no matter how efficiently a properly designed telephone plant may be operated in part by the employees of the company, the use made of such facilities by the public determines its efficiency and the company invariably and unjustly bears the burden of the responsibility. Consequently, the greatest problem that confronts the telephone engineer is to devise a plan to systematically and efficiently educate the public in the use of a telephone system.

The average person will admit he knows nothing of the mysteries of the electric light, the street railway, the telegraph, the gas or the water service, and will admit that it requires specially trained people to provide these services and to operate them, and the advice of such people as to the use of such utilities will be heeded generally without question, but for any trained employee to intimate to the public that the self same public does not know how to use a telephone means that that employee begins to earn his salary right there.

While the telephone engineer has many problems to solve, the greatest one—the one that so far has not been mastered—is the education of the public in the use of the telephone and an endeavor to have the public co-operate with the company in its effort to provide a service satisfactory to all. As a matter of course, all of his problems have a distinct relationship one with another, and while such engineering questions as transmission, distribution, and operation are sufficiently complex in themselves, they are rendered more difficult of solution by the ever attendant

problem of public relations and education of telephone small units with which the telephone engineer must deal.

A comprehensive telephone service is designed upon the primary base of its use by a great number of persons, a great number of times, and for very small units of time. This very characteristic must demonstrate that this can only be done with a multitude of units which, owing to the nature of the utility, are very small. A little thought given to this question will develop that in the matter of providing telephone service, more units, and units of less size, are required in the telephone business than in most any other, and surely than in any other public utility.

Pacific Statistics.

In dealing with these telephone facts I do not intend to present to you a mass of telephone statistics gathered from the telephone world, but to confine myself as much as possible to facts and figures, so far as statistics may be concerned, to those of a local character; in other words, a home product, and consequently will tell of some of the facts and some of the problems of the company with which I am connected—the Pacific Telephone & Telegraph Company.

Practically every person who is actively engaged in business has a telephone at his elbow. From the company's viewpoint, the telephone at your elbow is a decidedly small part of the equipment necessary in supplying telephone service and the object of my talk is to give you an idea of some of the problems of the telephone company which lie beyond the telephone you use and of how these problems are met. I might say right here that the function of any telephone company is to provide satisfactory service to the community it serves in such quantities as may be required by the various classes of telephone users and at such rates as will permit paying a fair wage to its employees and a small and fair return upon the capital invested. For the Pacific Company to do this it is necessary that its plant be made up in part of a multitude of the small units, to which I have referred.

This company has connected in its service subscribers stations that it owns to the number of 547,874, and connecting with its exchanges but owned by connecting companies, 104,032, making a total of stations served by it—651,906. To give a universal service to its owned and connected stations the Pacific Company has 897,509 poles, or approximately 24,257 miles of pole line, nearly enough to encircle the earth, and in its underground and aerial wire plant it has a total of 1,806,169 miles of wire, the major portion of which is No. 22 gauge and none larger than No. 8 gauge copper and No. 6 gauge iron. Of this amount 224,896 miles are in open wire construction, 509,897 in aerial wire and 1,065,257 in underground cable and 6119 miles in submarine cable. It has 3614 miles of single duct underground conduit occupying 810 miles of street, or a distance greater than from San Francisco to Portland, Ore., while the single duct, if connected in line, would reach from San Francisco to Chicago.

The subscribers stations referred to are served by the wire plant just enumerated through the medium of 607 exchanges and 1076 toll stations, with an auxiliary of 4047 private branch exchanges. The 547,874 stations of the telephone company and the 104,032 connecting stations represent approximately 650,000 subscribers who are connected by 252,976 exchange lines and which are given service from the central office through switchboards ranging in capacity from one operating position to those requiring several hundred positions.

A description of the multitude of small units required to make up the average central office would be a subject in itself and time will permit only of brief reference. It may be interesting to know that the wire mileage within our central office switchboards is approximately 250,000 miles. Connected with this wiring are 330,000 answering jacks and 5,580,000 multiple connecting jacks, 1,500,000 relays of various types, 1,200,000 24 volt lamps and a proportional amount of cords, keys, resistances and impedance coils and apparatus of a like character. This plant provides service for the 650,000 stations connected with it by completing 770,000,000 exchange calls and 16,000,000 toll calls each year. In addition to the completed calls handled, a great many calls which are not completed, due to the fact that the subscribers' lines are busy or the subscribers are out, are also handled. About 25 out of every 100 local calls made cannot be completed upon first attempt and between 12 and 15 of these 25 calls fail because the line called for is already busy. About 8 to 10 fail because the person called does not answer or is so slow in answering that the calling party hangs up and abandons the call.

Operating Methods.

The nature of the telephone service is such that it is necessary to promptly complete each call received. It is also necessary to maintain a uniform and efficient service each hour of the day and each day of the year, and we must be prepared for the unexpected as well as for the usual. Switchboards, trunks, toll circuits and operators are required to handle a maximum traffic at any period of any day and for the heaviest days. Each day has its busy and its slack hours; for example, in one of our offices we handle nearly 10,000 calls between 10 a. m. and 11 a. m. and in the same office we handle 2000 calls between 6 p. m. and 7 p. m. To meet these expected fluctuations is part of our daily work. However, we must be prepared to meet unusual conditions and emergencies; unexpected storms, large fires, extremely hot or cold days, make sudden and heavy demands upon the system. By arranging our operating loads, by keeping reserve apparatus and a reserve force within call, we are able to meet all emergencies.

It is to be expected that in handling this large volume of traffic some mistakes will be made and it may appear surprising to state that our records show that the subscribers make as many mistakes as the operator. The operator must proceed instantly with every call and handle the varying conditions which arise without waste of time in trying to decide what to do. It is necessary, therefore, to have detail methods and rules covering each operation prescribed in advance if a thoroughly efficient and reliable service

is to be given to the subscriber. For this purpose standard local operating methods, which are the result of extended study, have been developed by the traffic engineers, which will result in the most satisfactory service to the public. They are designed to protect the subscriber in every feasible way from disturbances due to the action of other subscribers or from the action of the operating force.

A great many people consider an operator at the central office as a mere machine. It is true that she does the same thing over and over many times day after day, but she is much more than a business machine. The operator deals with people of various nationalities and tempers and she is expected to be just, considerate and courteous at all times. The operators are a carefully selected and trained body of young women who are given a thorough course in our operating school before they are permitted to engage in the actual work of operating. The school course requires about four weeks and is designed to teach the fundamental principles of telephone operating, as well as the actual handling of the apparatus under conditions as nearly like the actual work of serving subscribers as possible.

Voice culture is given special attention, so as to develop correct enunciation. Their working surroundings have been planned with every attention to efficiency and comfort. All the complicated equipment of the operating room, even to the chairs in which they work, has been engineered with the idea of permitting the operators to furnish the best service with the greatest possible ease. The physical conditions under which the operators work are very favorable and the comfort and welfare of the operators is given special attention.

Anticipation of Service Requirements.

The operations of the Pacific Telephone & Telegraph Company extend over the entire coast, from Canada on the north to Mexico on the south, embracing the four greatest states of California, Oregon, Washington and Nevada and a portion of the state of Idaho. This vast area, 1100 miles from north to south, 535 miles from east to west at its widest point, embraces some 458,700 square miles, representing 1/7 of the total area of the continental United States. The population in this section has increased in the last six years from 3,800,000 to 5,200,000, or 36 per cent, while the population in the continental United States has increased over the same period only 16 per cent.

Consequently, one of the problems is to determine where the customers for telephone service would be located so the necessary facilities can be provided. Manufacturers and merchants can ordinarily control or regulate the growth of their business and can generally wait until they have business in sight before making extensions of plant, or they can rent quarters for temporary busy periods and go back to normal conditions when the rush is over, but the public utilities, particularly the telephone company, must, under the law, be ready with reasonable promise to serve a customer on demand in any part of the territory in which it operates.

[To be continued]

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The mere possession of information, knowledge acquired passively, is worth as little as the mere hoarding of money. But when such passive knowledge becomes active, when it is used, when it has entered directly into one's life, it becomes exceedingly valuable. It is not what a man knows, but what he does with what he knows. Use is the measure of value.

Experience is applied knowledge. On the basis that it is worth what it costs, experience is man's dearest possession. But the wise man applies the knowledge of others so that it becomes a part of his experience. Wisdom may be defined as the right use of knowledge.

Reading is the easiest way to filter the experience of others. The wise man reads to enrich his own experience, not merely to garner facts. By coming in close contact with the wide and varied life of others, he broadens his own vision and increases his own usefulness. Reading would be a waste of time if it were not for the fact that it gives, almost for the asking, experiences which other men have bought at great cost of time and energy.

Current technical literature records the latest experiences of men in specialized fields. For those in the same field of daily effort, such records save duplication of effort; those in other fields are prepared for the bigger and broader life to which their applied knowledge entitles them.

Some doubt seems to exist regarding the statement in these columns last week that "engineering ethics are insistent that expert engineering opinion cannot be colored to favor the case of any client." The code of ethics adopted by the American Institute of Electrical Engineers in 1912, wherein it states:

The engineer should consider the protection of a client's or employer's interest his first professional obligation, and should therefore avoid every act contrary to this duty.

is quoted as authority to the contrary.

But such doubt is authoritatively removed by the first principle outlined in this code which insists that "In all his relations the engineer should be guided by the highest principles of honor." It is further stated that if any considerations interfere with his meeting the legitimate expectation of a client, the engineer should inform him of the situation.

As a witness, the engineer's attitude should be that of an impartial judge of the facts found in his investigation. The opposing lawyer naturally tries to place him in the false position of an advocate. Because of this predicament many engineers find difficulty in making their point clear to a judge, jury or commission. Their trouble usually comes either from a too technical treatment which the layman cannot

Engineering Honesty

grasp or because their anxiety to simplify their testimony lays them open to the accusation of introducing extraneous matter to cloud the issue. Furthermore few engineers have sufficient knowledge of the law of evidence. If in doubt whether a question is admissible they should at least wait long enough to allow an objection to be interposed before answering.

An engineering witness should tell the truth, the whole truth, nothing but the truth. However he need not volunteer opinions that would be prejudicial to his employer's interest.

The Pacific Association of Consulting Engineers has been endeavoring to obviate some of these difficulties by having expert witnesses appointed by and compensated through the agency of the court.

While such a practice would be of material assistance, the engineer should always remember his early training with the instruments of precision, should make his statements absolutely square with the truth and never allow his actions to deviate from the hair-line of honesty.

Of the several power-tinkering bills presented at the present Congressional session Bill No. 16,673 introduced in the House of Representatives on May 19, 1914, and favorably reported by Representative Graham from the Public Lands Committee on June 16, is reputed to be the "administration measure" and consequently has the greatest life expectancy. Like others of its kind, it is heralded as the panacea for all the ills with which hydroelectric power development is now afflicted and as the salvation for public ownership of public lands.

While Westerners do not deny that some relief is needed from the present throttling policy, careful investigation fails to reveal it in this measure.

In the main, this bill proposes to invest the Secretary of the Interior with discretionary power to lease water power sites in the public lands for periods of not more than fifty years. At the termination of the lease, either by expiration or for breach of terms, the property is either forfeited to the government upon payment of depreciated costs of construction or may be again leased to new parties paying such costs. The Secretary may give preference to state, county, and municipal systems, specify the rentals, and regulate the service, charges and securities of companies doing an interstate business.

Without discussing the grave question of the constitutionality of conferring such legislative powers upon the Secretary and without questioning the justice of a discriminatory excise tax on this industry or on these Western states, consider the real effect of these provisions in repelling capital, the factor upon which new development is primarily dependent.

Experience has demonstrated that a great hydroelectric system cannot be completely developed in much less than fifty years. Most of the great projects in the West are still in the period of new construction and extension after twenty-odd years of intensive development. A mushroom plant cannot serve the best interests of the people. A short-time bond

on a property having no period of active earning is not readily saleable. Likewise in a bond market where municipal securities are competing for favor with public utility offerings, the discrimination which the Secretary may exercise in favor of municipal projects, particularly as regards rentals for property and rates to consumers, cannot but prejudice investors against private securities.

But the provision of most manifest unfairness is found in the payment to be made for the property in case it is taken over by the government. All those items, such as rights of way, water-rights, and land, which are subject to legitimate time appreciation in value are to be appraised at actual first cost, while those other items which are subject to depreciation are to be appraised at their depreciated value. Furthermore, no intangible value whatsoever is to be allowed. Naturally the thinking investor will wonder whether the meager returns from a property under development will compensate for the wear and tear on apparatus, the normal hazard of all business and the possibility of "fire, flood or other causes beyond human control."

Even those provisions of this bill which are not ambiguous in application, engender a feeling of doubt and uncertainty which is not conducive to confidence. But as all investment must be predicated upon confidence, money will seek channels of less resistance and development will stop because the wherewithal is lacking.

It is thus seen that this bill will defeat the very purpose for which it is alleged to have been drafted. And in stopping new development it prohibits competition and thus strengthens the position of those systems which were developed before these days when it is a crime to be successful.

While this journal has always been foremost in championing those factors which have developed the latent resources of the West, it has been equally insistent that a proper balance be maintained between public and private interests. The public has interests and rights which should be protected. But that public lives west of the Rocky Mountains in the states which have not wasted their patrimony and are not seeking to gain control of another's inheritance.

The West stands as a unit against those principles of this bill which provide absentee landlordism. Sectionalization, not centralization, is the need in this country which is already foremost in the regulation of public utilities. No bill should be passed which has not received endorsement of the people who will be most vitally affected by its enactment.

The proper authorities, the Secretary of the Interior for instance, should call a great meeting of Western representatives to consider this matter. Then, and then only, should a bill be passed by Congress. United action is now necessary. Every reader of this journal should write to his Congressman and urge that such action be taken and that no bills regarding the leasing of sites on non-navigable streams be passed at the present session.

Otherwise we may well follow the customs of far-away Bhutan, whose pious men pray with their water wheels by placing their written prayers in a cylinder revolved by a jet of water.

Water Wheel Prayers

PERSONALS

F. H. Leggett, district manager of the Western Electric Company, was at Seattle, Wash., during the past week.

Hazard Stevens, president of the Olympia (Wash.) Light & Power Company, was a Seattle visitor during the past week.

J. Priestman, chief clerk, light and power department, B. C. Electric Company, is spending a vacation at Metchosin, B. C.

Rowe McCune of Toronto, Ont., has been appointed local manager at Vancouver, B. C., for the Otis-Fensom Elevator Company.

Jos. S. Thompson, president of the Pacific Electric Manufacturing Company, San Francisco, is making an extended business trip through California.

A. E. Morphy, assistant secretary of the Southern California Edison Company at Los Angeles, was at San Francisco during the past week.

E. M. Cutting, manager of the Edison Storage Battery Supply Company, San Francisco, recently returned from a several weeks' trip through the Northwest.

W. S. Berry, sales manager of the Western Electric Company, San Francisco, is making a short trip through the north of bay counties region of California.

J. H. Willard, of the Laco-Phillips Company, New York, is at Prince Rupert, B. C., from Vancouver, where he has an office as B. C. representative of the firm.

Thos. Finnigan, vice-president of Pierson, Roeding & Co., San Francisco, stole a march on his many bachelor friends this week and joined the ranks of benedicts.

F. J. Gibbons, sales manager for the Jefferson Glass Company Ltd., at Toronto, Canada, is at San Francisco in the course of a trip throughout the Pacific Coast.

H. G. Dran, plant inspector for the Western Electric Company, Hawthorne, Ill., arrived in San Francisco during the week on his inspection trip of the Coast houses.

D. E. Harris, of the Sales Department, Pacific States Electric Company, San Francisco, returned during the week from an extended trip through the north of bay counties region.

P. B. Hyde, representative of Thos. A. Edison Co., with offices in San Francisco, returned the first part of the week after a month's trip to Salt Lake City, various Montana and Idaho cities.

J. T. Stewart, salesman with the Pacific Coast office of the Holophane Works of the General Electric Company, left San Francisco this week to attend the summer sales conference at Cleveland, Ohio.

A. F. S. Steele, secretary Washington Water Power Company has returned to Spokane, Wash., from Houston, Tex., where he attended the International Convention of Rotary Clubs as the Spokane delegate.

L. A. Somers, in charge of the Industrial and Power Sales Department, Westinghouse Electric & Manufacturing Company, returned to San Francisco during the week, after an extended trip through Southern California.

John R. Brownell, formerly superintendent of the department of safety of the Pennsylvania Steel Company, has been recently appointed superintendent of safety for the Industrial Accident Commission of California.

W. H. Hanbridge, secretary of the California State Electrical Contractors' Association, was a visitor to Sacramento, Cal., during the week, where he completed details in connection with the coming annual state convention of his organization.

H. W. Beecher, Seattle manager; **James Burke**, Salt Lake manager; **W. H. Crawford**, Portland manager; **H. H. Clark**, Los Angeles manager, and **Geo. W. Hawkins**, Tucson manager

for Chas. C. Moore & Co., are attending a company sales conference at San Francisco.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, has been appointed chairman of the General Convention Committee for the convention of the National Electric Light Association to be held at San Francisco in June, 1915.

F. W. Gitchell, who was formerly connected with the British Columbia Electric Railway Company, is at San Francisco en route to Winnemucca, Nev., to look after business matters in connection with the Charleston National Gold Mining Company in which he is interested.

Harry B. Dresser, correspondent for the Westinghouse Electric & Manufacturing Company for the past three or four years, at Salt Lake City, has been transferred to the district office of the Westinghouse Lamp Company, with offices in Salt Lake City as chief correspondent.

G. H. Morgan, telephone manager, Melbourne, Victoria, and **S. L. Monghan**, assistant telephone manager of Sydney, N. S. W., who were instructed by the postmaster-general of Australia to make a series of telephone investigations in America and Europe, recently spent a week in San Francisco en route to the East.

Lloyd Garrison, power engineer of the commercial department of the Utah Light & Railway Company, was married on Thursday, July 9th to Miss Josephine Evelyn Dresser of Salt Lake City. Mr. Garrison is a graduate of the University of Illinois, class of 1907, and has been in the employ of the Utah Light & Railway Company for the past five years.

Frank Seal has returned to Salt Lake City from Milwaukee where he has been studying for the past two years in the School of Engineering. Mr. Seal was formerly in the employ of the Capital Electric Company as construction foreman and later as traveling salesman. He has now taken a position as city salesman with the Inter-Mountain Electric Company.

Raymond E. Dresser, district superintendent for the Utah Power & Light Company, with headquarters at Montpelier, Idaho, is in Salt Lake City to attend the wedding of his sister Evelyn to Mr. Lloyd Garrison. Mr. Dresser will take a two weeks' vacation before returning to his duties. He reports much interest in southern Idaho in electric cooking. The demonstrations which his company has made during the past two or three months has stimulated a marked demand for electric ranges amongst the well-to-do farmers in his district. Crop conditions in that section of the country were never more favorable and he is anticipating good business conditions will follow the harvesting of this season's bumper crops.

Frederick K. Lane, general manager and treasurer of the Seattle Lighting Company, was host at a luncheon served in the condenser and scrubber room of the works of the company at Seattle, Wash., to the members of the Publicity Industrial Bureau of the Seattle Chamber of Commerce. **John W. Lansley**, a Chicago newspaperman who has graduated into the gas industry, interestingly described to those present the various processes in gas manufacture. During his discourse he eulogized **S. R. Hutchinson**, assistant manager of the company; **N. C. Fancher**, superintendent, and **H. A. Miller**, engineer of the National Chamber Oven Company, who is at Seattle superintending the installation of ovens for the company.

M. C. Osborn, commercial agent Washington Water Power Company at Spokane, Wash., has just placed one two ton electric truck with the Beardmore Transfer Company, and a one ton truck with the Pacific Transfer Company. **Lewis A. Lewis**, assistant commercial agent, is stated to have said in connection with the sale of these trucks that a new plan is to be adopted by his company in charging for energy used. The cars have been sold without storage batteries

and for the use of these the company charges a rental depending upon the power used. In this way the rate is said to vary from 1¼ to 7 cents per car mile, depending upon the capacity of the car. Batteries are charged to run 45 miles and the cars are equipped with an indicator so that the driver may know the condition of the batteries. A run to the company's garage enables the dead batteries to be replaced with a recharged set. Considerable success is anticipated for this new system.

MEETING NOTICES.

California Association of Electrical Contractors' Convention.

The fifth annual convention of the California Association of Electrical Contractors and Dealers is to be held at Sacramento, August 4 to 8, 1914. An elaborate programme has been prepared, and papers by men prominent in the field of electrical endeavor are to be presented. The indications are for a record-breaking meeting, and the capital city is making extensive preparations for the entertainment of the delegates.

Telluride Association.

The annual convention of the Telluride Association, which has been in session at Provo, Utah, since June 22d, adjourned on July 6th to reconvene at Provo, Utah, on June 23, 1915. About fifty young men were granted scholarships at Cornell, Princeton, Purdue, Stanford, University of Missouri, and other universities. The following officers were elected for the ensuing year: President, L. G. Nightengale of New York; vice-president, David Wegg Jr., of Chicago; treasurer and Manager, W. L. Biersach of Provo; secretary, B. Landon Jr., of Chicago; dean, E. A. Thornhill of Boise, Idaho.

Utah Electric Show Association.

The Electric Show Association of Utah at a recent meeting of its board of directors decided to disband the association and distribute the capital funds and surplus now held in the treasury to the stockholders.

This association was incorporated three years ago for the purpose of giving an electric show in Salt Lake City. This show was held and was a highly successful one both from a result producing and a financial standpoint. The stock of the association was subscribed and taken by the various electrical interests represented in the state. A substantial dividend was paid after the first electric show and the surplus left in the treasury to be used in case subsequent shows were given. As a result of the impetus given the electrical appliance game by this show, the use of electrical appliances have become much more common than they were at that time and the directors have felt that the necessity of giving a show does not exist nearly to the extent now that it did then. In case it is decided later on to give an electric show it will not be a difficult matter to raise the necessary funds to do so. The central station companies, manufacturers, jobbers and supply dealers are now convinced of the opinion that one can be conducted on a profitable basis and it would not be a difficult matter to raise the necessary funds for this purpose in case it was decided to put on a show at some later date.

Pacific Claim Agents' Convention.

About forty members and guests attended the sixth annual convention of the Pacific Claim Agents' Association held at Spokane, Wash., on July 9, 10 and 11, 1914. Sessions were held in the Stone Room of the Hotel Spokane. An address of welcome was made by Wm. J. Hindley, mayor of the city, and other addresses were made by D. L. Huntington, president Washington Water Power Company, and by Waldo G. Paine, vice-president Spokane Inland Empire System. Papers were presented as follows: "What methods should be pursued in keeping informed of the movements of witnesses in cases where litigation is likely to arise," by A.

M. Lee, assistant general claim agent, Northern Pacific Railway Company, Seattle, Wash. "What are the most effective methods that can be adopted by public service corporations in prosecuting fraudulent claimants and professional witnesses?" was presented by Harrison Allen, attorney Portland Railway, Light & Power Company, Portland, Ore., and by John S. Mills, assistant superintendent San Francisco-Oakland Terminal Railways, Oakland, Cal. "The prevention of automobile accidents" was discussed by S. A. Bishop, general claim agent, Pacific Electric Railway Company, Los Angeles, Cal., and by J. H. Handlon, United Railroads of San Francisco, Cal., president of the association. "Statistical information showing the accident cost of trainmen with respect to length of service," was presented by H. G. Winsor, claim agent Tacoma Railway & Power Company, Tacoma, Wash., and by Thomas G. Aston, claim agent Washington Water Power Company, Spokane, Wash. "To what extent can the claim department co-operate with the operating department in the matter of selecting trainmen as to their moral, mental and physical fitness?" was ably discussed by B. F. Boynton, claim agent Portland Railway, Light & Power Company, and by A. E. Beck, claims solicitor, B. C. Electric Railway Company, Ltd., Vancouver, B. C. A paper on remedying the trespassing evil was read by H. K. Rolf, general claim agent Spokane, Portland & Seattle Railway Company, Portland, Ore. Geo. Carson, general claim agent Puget Sound Traction, Light & Power Company, Seattle, Wash., and T. A. Cole, claim agent Los Angeles Railway Corporation, Los Angeles, Cal., read papers on the question, "Is it advisable for a statement to be secured from an injured person immediately after an accident occurs without regard to liability or the intention of the injured person to file claim?" In the absence of the author, a paper on "The evolution of 'Safety First'" by T. M. Lyall, assistant claim agent B. C. Electric Railway Company, was presented by one of the delegates. "What policy should be adopted in the disposition of claims of doubtful liability?" received attention at the hands of T. J. Rupli, assistant claim agent Puget Sound Traction, Light & Power Company, and Mrs. Ida P. Newell of the Portland Railway, Light & Power Company. The final session was devoted to a committee report on "Safety"—(A) from standpoint of (1) the public, (2) the companies; (B) Safety work of various companies, to general business, and the election and installation of officers. The association's new Safety Library was also exhibited at this session.

NEW CATALOGUES.

Duncan Electric Manufacturing Company has issued an attractive bulletin illustrating and describing its model M. I. Induction type Watthour Meter.

Holophane Works of General Electric Company are distributing their catalogue No. 311 on the Ivanhoe Counter Line of Metal Reflectors and Portable Fixtures. The revision of this line and the new schedule of discounts shows a careful study of interests of the trade.

The Wagner Electric Manufacturing Company, St. Louis, Mo., has just issued a bulletin on Central Station Lighting Transformers. The bulletin describes the distinguishing features which have characterized Wagner Transformers for many years, such as variable voltage taps, patented one piece porcelain outlet bushings, specially designed clamps for holding active material in the case, etc.

Simplex Steel Taped Cable is the title of a 16 page booklet which describes briefly the manufacture and uses of the cable which is protected by two steel tapes wound on spirally in reverse directions. The book illustrates and describes briefly, methods of installing steel taped cable in ornamental lighting systems, parks, the grounds of public buildings, and in railroad and manufacturing yards.

ELECTRICAL CONTRACTORS' DEPARTMENT

CO-OPERATION BETWEEN ELECTRICAL CONTRACTORS AND JOBBERS.

(This paper deals with the principles advocated by a joint committee of electrical jobbers and members of the California Association of Electrical Contractors and Dealers, giving an outline of the work which the committee propose to do.—The Editor.)

It is a recognized fact that certain branches of the electrical industry are today in a demoralized condition. As this is due largely to lack of proper co-operative effort on the part of the different branches of the industry it is the belief of the committee that, with a proper organization, whose primary interest is to educate its members to a greater responsibility, much good can be done in the way of properly serving the consumer and of creating a desire on his part to use electrical appliances and to adopt the idea, "Do it electrically," the slogan of "The Society for Electrical Development."

As examples of what can be accomplished, we only have to review the work of improvement clubs, societies, chambers of commerce and similar organizations throughout the country. Could individuals in the same period of time have brought about the reforms and changes in business methods that these associations have accomplished for their membership? The Panama-Pacific Exposition, about to be opened in San Francisco in 1915, is an evidence of co-operative association team work.

The Central Stations, through their strong organization, the National Electric Light Association, have brought the lighting and power industry to a high degree of development, and while doing so have reduced rates to the consumer—neither of which could possibly have been accomplished through individual effort.

Electrical Engineers, through the American Institute of Electrical Engineers, have been better prepared for their work through fuller knowledge of the requirements to be met and of the means of fulfilling them. This institute is conducted purely for educational purposes and without individual profit to its members, except in so far as they improve themselves by participating in the work.

Electrical Manufacturers and Jobbers through co-operative work have done much toward educating themselves, and as a result have placed their business on a firmer, more economical and more satisfactory basis. It has been proved through this work that, notwithstanding the increased cost of living and the consequent increase in the cost of almost every known commodity, the cost of electrical appliances has been steadily reduced and the quality of the article steadily improved. The principal effort on the part of these industries has been toward educating their members to the necessity of efficiency in order that the various branches may operate their particular businesses at a minimum of expense.

Architects have the American Institute of Architects as their national association. We would hardly recognize as progressive an architect who is not a member of this institute. Some of his most valuable information is obtained through such membership and through his affiliation with other architects in association work.

While undoubtedly electrical products have made more rapid strides in the last ten years than any other industry, the building industry generally has kept apace with the times. It is the belief of the committee, however, and it will be admitted by architects generally, that while satisfactory progress has been made in the building industry, at least from an architectural standpoint, the electrical equipment in buildings of all classes has been steadily neglected, and it is common practice today among many architects to use electrical specifications which have been regarded by the elec-

trical industry for a long time past as absolute.

San Francisco today is an evidence of this. It has been almost entirely rebuilt within a period of seven years, and yet probably more than 95 per cent of the buildings erected in that period prove conclusively that the electrical specifications (and the ultimate installation) were neglected by architects generally. Of the remaining 5 per cent, probably not more than 25 per cent, or 1¼ per cent of the whole, have been equipped with modern electrical installations, and in making this estimate all classes of buildings have been taken into consideration.

Very recently certain firms of architects in San Francisco have engaged competent electrical engineers to prepare for them suitable specifications, but notwithstanding the engineer is handicapped in the preparation of specifications on account of the small proportion of the total cost of the building allowed him as his share. This condition is, of course, a direct reflection on the individual or firm of architects making the allowances.

The occupant of any commercial type of building, hotel, apartment house, flat, bungalow, or private home generally realizes only too late that no provision has been made for the many electrical conveniences. Many attempts have been made on the part of electrical people to assist architects in the drawing of proper specifications, but they invariably receive no encouragement, as certain architects really believe that they have forgotten more about proper electrical installations than all the electrical men in the country ever knew, and for this one reason they are impossible to approach.

They make no distinction between the reputable and the irresponsible electrical contractor. Their one idea seems to be to let the electrical contract simply on price. The result is evident:

Original cost of installation.....	100 per cent
Extra before occupancy of building.....	25 per cent
Extra after building is complete.....	50 per cent

and the installation is still incomplete. An additional allowance, in the first place, would undoubtedly have provided a better installation with less cost to the owner.

Electrical contractors have their national and state associations, which have done much to educate their members in the proper conduct of their business, and through their local meetings and state conventions have made possible an exchange of ideas that has tended to elevate the standard of work.

Notwithstanding the great results that have been accomplished by the association, there are many electrical contractors who have failed to recognize the advantages to be gained by such association effort. This is evidenced by the present state of the electrical contracting business.

In the past, when a contractor has been approached and the suggestion offered that he become a member of the association, he has immediately asked, "What am I to gain by joining it?" The answer to this question is that he gets out in proportion to what he puts in. Having put in nothing in the past, nothing is what he has gotten out.

It is the belief of the committee that an electrical contractor unattached is unable to keep apace with the progress of the industry, and consequently is unable to properly serve his customers.

If he will become a member of the association and will give it his support, it would be impossible to estimate the benefits he will derive from it, as evidenced by the results of association work in other lines of endeavor, whether commercial or political.

As we have shown above that a competent architect should of necessity be a member of the American Institute

of Architects, or in some way affiliate with its local chapters, so it is clear that an electrical contractor should for the same reasons be a member of some association which represents his craft.

Distribution of Electrical Material.

It is fully recognized that the economic and proper channel of distribution of electrical supplies is through the electrical supply jobber to the dealer and contractor, who, in turn, serves the consumer. By this method of the dealer and contractor is enabled to have the advantage of a complete stock of electrical merchandise in the warehouse of the jobber, which can be drawn on at any time, no matter whether it is one item or a hundred, and can be assured of prompt shipments and satisfactory service from every standpoint.

The jobber makes it his business to keep in close personal contact with the dealer and contractor in his territory, studies his wants and plans to serve his needs, no matter what they may be. Through frequent calls of his salesman he is often enabled to give valuable information, keeping him advised of the new lines of standard goods on the market and furnishing technical data or give such other information as may be useful from time to time.

He is frequently able to be of service by carrying his contractor or dealer, who has been tied up financially on account of delays in jobs over which he has had no control.

This kind of service cannot be had where the contractors and dealers do business at long range and with people who are not in close touch or sympathy with their conditions or problems.

The dealer and contractor is the natural channel for distributing various electrical devices to the consuming public. He carries the material in stock and displays it on his counters and in his show windows. The consumer is thus enabled to see the material which he is purchasing, and knows that he is getting full value for his money. He can get promptly any information he needs or instructions in the use of the various electrical devices which is a service that could not be rendered satisfactorily by correspondence with some distant point.

Policy of Committee.

The object of this joint committee is to promote the use of electrical appliances and to influence the public to adopt the idea: "Do it electrically."

The co-operation of the central station in each district is highly desirable, and a closer relationship with the architect and those engaged in the industry must be maintained. In the past the industry has failed to provide suitable show rooms at which the consumer can obtain electrical appliances, therefore we will encourage the establishing of proper stores where material can be obtained at retail.

To accomplish this end a campaign of education is about to be instituted. It provides for visits by the committee to all parts of the state, where public lectures will be given, supplemented by moving pictures, stereopticon views and working demonstrations of electrical appliances.

In order to gain the full confidence of the public in the industry we represent, the class of material furnished and the excellence of workmanship in its installation must be of the highest order. We should never recommend for sale an article in which we have not absolute confidence and a full knowledge of the functions it will be called upon to perform.

We should not consider an installation as tending to promote the best interests of the industry unless it has met with the unqualified conviction on the part of the contractor that it is of the highest class. An installation made by an electrical contractor, simply because it will pass inspection, is undoubtedly bad practice.

We recognize that, in our business probably more than in any other, the public is woefully ignorant of the quality and merits of electrical devices. Whether or not they are

satisfied depends upon how we serve them. We should recognize that the National Electric Code, while having accomplished a great good, does not to the fullest extent accomplish the desired results, for the reason that it does not distinguish between standards of material.

We will advocate the grading of material by the National Fire Protection Association.

We recognize that local inspection bureaus are not responsible for installations in compliance with architects' specifications.

We will advocate the employment of one or more competent electrical engineers, whose duty it will be to furnish architects with certificates, certifying that work has been performed in accordance with the specifications embodied in the contract.

Work may be performed which in every respect meets the requirements not only of the National Fire Protection, but local, state or municipal inspection bureaus, which is not a credit to the electrical industry. We are opposed to electrical contractors who, after executing a contract, endeavor to substitute material of a lower grade. We advocate that the various electrical contractors' associations should assume the responsibility for seeing that their members perform work in accordance with specifications without attempting to evade their contract in any detail.

We believe that with proper co-operation on the part of the architect and other allied interests, the various state associations of electrical contractors will ultimately be able to guarantee on behalf of their members the completion of any contract entered into.

We will ascertain the names of all societies of architects, times and places of meeting, and will endeavor to have representative electrical engineers, as well as members of our joint committee, appear before these associations to explain the necessity of not only the proper drawing of, but also the compliance with recognized modern specifications.

Caution should constantly be exercised to see that only those contractors are admitted to membership of an association whose character and honesty are unquestioned and who have an established reputation for square dealing.

ELECTRICAL CONTRACTORS' NOTES.

Smith & McCoy have the electrical contract on the apartment house being erected on the corner of Twenty-first & Glisan streets, Portland, Oregon.

The General Electric Company has obtained the contract for 1-200 h.p. and 1-150 h.p., 3-phase, 60-cycle, 440-volt induction motors to be used in connection with the new ice hippodrome in Portland, Oregon.

The Central Electric Company, San Francisco, is putting in the electrical equipment for the Union Pacific's Yellowstone Park Exhibit at the Panama-Pacific International Exposition. The contract price is \$6583.

The Morrison Electric Company has obtained the contract to furnish and install the electrical fixtures in the new 12 story office building of the Pacific Telephone & Telegraph Company, which has been recently erected in Portland, Oregon.

The W. W. Smith, Electrical Engineering Company, Spaulding Building, Portland, Oregon, has obtained the electrical contract for the wiring of the new Burnside Theatre, being erected by A. C. Ruby on Fifth and Burnside streets, Portland, Oregon.

The Inter-Mountain Electric Company of Salt Lake City is just starting construction work on the electrical wiring and equipment of the new bank building and hotel being erected in Logan, Utah, by the Thatcher Bros. Banking Company, replacing the former bank building which burned down a year ago.

Ne Page, McKenny & Company have obtained the contract to complete the electrical installation in the Homeopathic Hospital, located at E. Twenty-second and Multnomah streets, Portland, Oregon. This building has been in course of construction for the past three years. Funds are now available for completion of the structure.

The Pacific Fire Extinguisher Company, San Francisco, is installing the general and decorative lighting wire for eight buildings at the Panama-Pacific International Exposition. These include the Food Products, Education, Agricultural, Liberal Arts, Transportation, Manufactures, Mines, and Varied Industries Buildings. The contract price is \$13,650.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision dismissing the application of the Indian Valley Electric Light & Power Company for a modification of the commission's order of September 21, 1912, authorizing the issue of \$81,535 bonds. The power company desired this modification in order that it might lease the reservoir site of the Round Valley Water Company at Greenville, Plumas county, and use the water therein to operate a new hydroelectric plant. At the hearing it developed that the right to the water was in litigation and the commission held that it could not authorize an issue of bonds based on a lawsuit where a substantial issue is involved in the suit. The application was therefore dismissed without prejudice to a renewal or presentation of a different plan by the stockholders of the Indian Valley Electric Light & Power Company.

The commission has rendered a decision dismissing the application of the Oro Electric Corporation and the Oro Development Company for permission to sell 1000 first mortgage 6 per cent sinking fund gold bonds, and to confirm the sale of 686 bonds of the Oro Electric Corporation. This action was taken upon the request of the companies involved.

The commission has rendered a decision in the complaint brought by the city of Los Angeles against the Southern California Gas Company, the Los Angeles Gas & Electric Corporation, the Southern California Edison Company and the Economic Gas Company. The city sought to compel the gas companies to resume the supply of natural gas to the citizens of Los Angeles. Since February 20, 1914, there has been practically no natural gas sold or used in Los Angeles, except by the Los Angeles Gas & Electric Corporation and the Southern California Gas Company in their own plants, although at the hearing it developed that a large supply was available. The jurisdiction of the commission in this case was in doubt. The commission finally decided that it had no jurisdiction to compel any of the companies to deliver natural gas in Los Angeles and insofar as the complaint asked for relief in this particular, it must be dismissed. The commission held, however, that it had power to order the Southern California Gas Company to resume the delivery of natural gas to the Los Angeles Gas & Electric Corporation and the Economic Gas Company at the West Glendale terminus of the Midway Pipe Line and made its order accordingly.

The commission has rendered a decision in the complaint filed by the town of Antioch, Contra Costa county, against the Pacific Gas & Electric Company. The complaint charged that the company's rates for electricity for general domestic and commercial use and street lighting were unreasonable.

In arriving at its decision, the commission made an investigation of the company's entire hydroelectric system, extending from the crest of the Sierras to the Pacific Ocean, and its steam plants as well as its local distributing system at Antioch. The Pacific Gas & Electric Company held that it should be allowed a return on the basis of the cost to reproduce its plant new plus an allowance for going concern value. In figuring the basis of return, the commission cut the overhead percentages to be added for administration, taxes, insurance, etc., from about 25 per cent, as estimated

by the company's engineers, to about 12 per cent. The decision then proceeds to fix an average cost for electric energy deliverable at substations. At the hearing of the case, it was agreed by the Pacific Gas & Electric Company that the basis fixed in this decision might be used as the basis upon which to ascertain the cost of energy delivered to any of the cities which it serves, and in fixing rates hereafter, it will only be necessary for the commission to determine the cost of distribution in any locality. This average cost as found by the commission is .007312 per kw-hr.

The Holton Power Company, of Redlands, has filed an application with the Railroad Commission asking authority to issue \$200,000 par value first and refunding mortgage gold bonds.

The commission has rendered a decision authorizing the Round Valley Water Company, of Greenville, Plumas County, to lease its property to the Plumas Light and Power Company, formerly known as the Indian Valley Electric Light and Power Company. The commission also authorized the power company to lease a portion of its property to Clara Bidwell. These two leases are part of a transaction by which the water stored in the Round Valley Water Company's reservoir is to be used for developing hydroelectric power.

The commission has made a supplemental order authorizing the Fresno Interurban Railway Company to issue 600 shares of stock and \$120,000 of bonds. The authority is conditioned upon the railway company securing a franchise through the town of Clovis, Fresno County, before July 20, 1914.

The Southwestern Home Telephone Company of Redlands, San Bernardino County, has filed an application with the commission asking authority to execute its promissory note in the amount of \$4500, with interest at a rate not to exceed 8 per cent per annum.

The Pacific Light and Power Corporation of Los Angeles has filed an application with the commission asking authority for an issue of stock and bonds. The proceeds are to be used for refunding floating indebtedness incurred on account of betterments, additions and improvements.

RULING SAN FRANCISCO DEPARTMENT OF ELECTRICITY.

In all disputes arising over the classification of any building, in so far as this classification determines the class of electrical construction which shall be used in wiring same, the department of electricity will accept the classification on the building permit as applying to Section "M" of Ordinance No. 2582. This shall not be construed to include flats with stores underneath, which shall be "all conduit" jobs. This ruling becomes effective at once.

TRADE NOTES.

The strike of the employees of the Westinghouse companies at Pittsburg was ended during the past week when all employees returned to work under the former schedule of time and wages. The Westinghouse Electric & Manufacturing Company and the Westinghouse Machine Company are again in a position to fill all orders.

The Standard Electric Time System is to be installed at the Western Residential Schools on Shaughnessy Heights, Vancouver, B. C., by Messrs. Chapman & Walker. The contractors are Hicks & Scattergood; Herbert Moss of Seattle, Wash., is consulting engineer, and McClure & Fox, Vancouver, B. C., architects.

The plant of the Salmon River Lumber Company about one mile from Sperling Station, on the Fraser Valley & Southern Railway, was destroyed by fire last week. The loss is estimated at \$40,000 and is said to have been mostly covered by insurance. It is the intention of the owners to at once commence rebuilding the mill which will be up-to-date in all respects.



NEWS NOTES



INCORPORATIONS.

LOS ANGELES, CAL.—Hoagland-Lakin Electric & Engineering Company has been incorporated with a capital stock of \$25,000. A. L. Lakin, H. A. Hoagland, M. W. Hulse, D. Schoonmaker, R. E. Amann are the directors.

RIVERSIDE, CAL.—The Twin Springs Water Company, principal place of business at Riverside, has filed articles of incorporation, with a capital stock of \$4000. The company plans to put water on Alamo tract. The directors are S. C. Evans, M. L. Evans, E. S. Evans, P. T. and C. Evans.

THOMPSON FALLS, MONT.—The Interstate Power Company has filed articles of incorporation to transact a mercantile, industrial, manufacturing and mechanical business, and create or obtain electrical power. Thompson Falls is the principal place of business. Edward Donlan, I. E. Keith and Andrew Peterson, are the incorporators.

CARSON CITY, NEV.—The Canyon Power Company, a California corporation, has filed articles of incorporation with the Secretary of State. The company has an authorized capital of \$1,000,000, divided into 10,000 shares of a par value of \$100. Leon M. Grove, H. L. Breed, Chas. Gross, J. E. Bowes and E. A. Herrmann of Oakland appear as the original incorporators and stockholders.

ILLUMINATION.

ST. HELENA, CAL.—Fifty-three 3-light electroliers were recently installed along Main street by the Napa Valley Electric Company.

DUNCAN, ARIZ.—J. B. Spaw has sold the local light plant to J. Allen, who, it is understood, plans to enlarge the plant in the near future.

PASADENA, CAL.—The city commissioners are contemplating the erection of an addition and improvements to the municipal lighting plant to cost \$20,000.

SANTA CRUZ, CAL.—The Coast Counties Gas & Electric Company has filed suit against the stockholders of the Santa Cruz Beach Company to recover \$41,429 for light and power.

DAWSON, Y. T.—The electors of the city of Dawson have voted in favor of selling bonds to the extent of \$200,000 for the installation and operation of a government owned light and power plant.

BAKERSFIELD, CAL.—C. H. L. Griest and C. H. L. Griest Jr. have applied for a franchise for 50 years, to maintain an electric pole, tower and wire system. Sealed bids will be received for such a franchise up to August 8th.

SEATTLE, WASH.—Bids will be received by the Board of Public Works up to July 24th for furnishing the city of Seattle lighting department during the year 415,500 incandescent lamps. A certified check in the sum of \$3000 payable to the city comptroller is required with each bid.

LOS ANGELES, CAL.—The Board of Works has signed a contract with the Los Angeles Gas & Electric Company to supply current to 500 new arc lights for 18 months at \$6.30 a month each and with the Pacific Light & Power Company to furnish current for incandescent lamps in the Hollywood District at \$1.50 each.

PORTLAND, ORE.—Announcement was made at a recent meeting of the Manufacturers' Association that the Electrolytic Gas Company of Dayton, Ohio, has determined to locate in Portland. E. F. Platt, president of the company, recently visited Portland to investigate the field with the view of establishing a plant.

SPOKANE, WASH.—C. M. Fassett, commissioner of public utilities has recommended that the city adopt nitrogen

filled Mazda lamps for street lighting purposes and in substantiation of recommendations quoted the saving thus effected by other cities. Mr. Fassett is reported to have made at that time, the erroneous statement that the new half-watt lamp is also available for domestic lighting purposes.

DRAIN, ORE.—The City Council has decided to sell \$6000 worth of city bonds to raise money to install an electric lighting system for the city of Drain. As soon as the bonds are sold the council will enter into a contract with the Douglas County Light & Water Company, of Roseburg. The company says it can complete the line from Winchester by November 1st, which will insure electric lights for Drain by that time.

SAN FRANCISCO, CAL.—Action was begun in the United States District Court Friday by the Pacific Gas & Electric Company to restrain the city from enforcing the 75c gas rate recently fixed by the supervisors. The gas company claims that at the proposed rate the receipts for the year to end June 30, 1915, will not exceed \$3,499,849. The expense of operating is placed at \$2,280,221 and the company claims that \$650,598 will be written off for depreciation. The net would thus amount to \$569,220, which, it is claimed, would give only 3¼ per cent to the stockholders.

TRANSMISSION.

SOUTH BEND, WASH.—The Willapa Electric Company has been granted the right to construct lines of transmission, distribution and utilization of electrical energy along Quincy street.

SALEM, ORE.—State Engineer Lewis has approved of the application of Geo. W. Holcomb, Portland, to appropriate 1500 second ft. of waters of Clackamas River for the development of 10,225 h.p. The estimated cost is \$1,000,000. An 80 ft. dam is proposed.

PORTLAND, ORE.—The state engineer has granted a permit to the Portland Railway, Light & Power Company to construct reservoirs on the headwaters of Clackamas River. The smaller to require a 30 ft. high dam for the storage of 17,900 acre ft., and the larger one to require a 80 ft. dam for 40,400 acre ft.

REDDING, CAL.—A tunnel a mile long has been dug in the Big Bend of the Pitt River as a starter to a power development project undertaken over a year ago by the Mount Shasta Power Corporation. The tunnel will be almost seven miles long. It is to convey water from Pitt River through a mountain divide to a point where a tremendous fall will be available for power generating purposes. The tunnel so far dug is seven feet wide and nine feet high. Later it will be enlarged to a width of 16 feet and a height of 19 feet. Crews are working at both ends.

FALLON, NEV.—When bids for the lease of the power from the Lahontan plant were opened at Reclamation headquarters last week, there was but one bid, that of the Canyon Power Company of Oakland, Cal. The present bid is for one-fourth of one cent, or \$.0025 per kw.-hr. for the gross output of the plant during the summer months, and \$.0037½ per kw.-hr. during winter months. This will make the minimum \$1200 per month for the months of April, May, June, July, August and September. The minimum annual income will be about \$14,000 and the maximum \$30,000, and the probable average about \$20,000 annually. If this contract is not made, it is a well-known fact that the Lahontan plant will be operated at a heavy loss after the next few months when the construction work at the dam will be completed. Under the proposed contract this prospective loss will be changed to a net profit in the above amounts.

TRANSPORTATION.

STOCKTON, CAL.—Bids will be received until July 20th for a 50 year franchise applied for by the Stockton Electric Railroad Company.

VANCOUVER, B. C.—It is authoritatively stated that the advance railway bookings to the Panama-Pacific International Exposition via this city already aggregate 4000 per day.

BILLINGS, MONT.—It is reported that officials of the Chicago, Burlington & Quincy Railroad are seriously considering the electrification of 500 miles of road adjacent to Billings.

SAN FRANCISCO, CAL.—The Board of Public Works received 11 bids for grading the site of the new car barn on Seventeenth street for the Municipal Railway, the lowest being that of the Daniel O'Day Company for \$34,850.

SEATTLE, WASH.—An ordinance has been introduced adopting a plan for making extensions to the street railway system by the construction of tracks over Fourth avenue, et al. The bill has been referred to the city utilities committee.

HEALDSBURG, CAL.—Alfred D. Bowen, who promoted the Petaluma & Santa Rosa Railroad, has applied to the city trustees of Healdsburg for a franchise for twelve miles of electric railroad out from Healdsburg through the Dry creek valley.

SACRAMENTO, CAL.—General Manager McGovern, of the Northern Electric Railway Company, announces that \$50,000 will be spent this summer in re-ballasting its roadbed, replacing wooden culverts with concrete. A fast through train service between Chico and San Francisco is to be inaugurated.

OGDEN, UTAH.—The Salt Lake & Ogden Railway Company has received eight large electric interurban cars belonging to the Orem road, the cars to be assembled and tested out by the Bamberger company before they are placed in service on the southern Utah line. The cars are of the latest type and equal in size to those of the Bamberger line.

SPOKANE, WASH.—The city has passed and the Washington Water Power Company has accepted a franchise for the Boone avenue extension and for Trent avenue, west of Division street. It is stated that the Washington Water Power & Inland Empire Companies have reached an agreement whereby the Water Power Company can commence work on its Boone avenue, extension without delay.

SAN FRANCISCO, CAL.—Action was taken last week by the supervisors looking to the extension of the municipal street car system through Golden Gate Park from Tenth avenue in the Richmond to the south site of the park, and the Potrero avenue line into the Scotch Hill section. Supervisor Vogelsang introduced a resolution, which was passed, requesting the city engineer to prepare plans to estimate the cost of this work.

SACRAMENTO, CAL.—An injunction permanently restraining the Pacific Gas & Electric Company from constructing double tracks across Tenth and K streets was granted to the city in an opinion handed down by Superior Judge N. D. Arnot of El Dorado as presiding judge of department 3 of the Sacramento Superior Court. This opinion terminated a contest between the city and the street car company, which was commenced in October of 1912 and which involved the rights of the car company under the charter and franchises. The principal point involved in the suit was the placing of tracks across K street. The city held it was a new piece of work; the company held it was the mere physical connection between two franchises already obtained by the company made necessary by the demand for better service.

SAN FRANCISCO, CAL.—The first shipment of four cars for the Municipal Railway has been made by the Jewett Car Company of Newark, O., and more will be sent this month. The contract calls for the delivery of 25 cars every month, beginning August 14th. A bonus of \$5 a day on each

car is allowed for early shipment each month. In all, 125 cars have been ordered. It is expected that the operation of the Van Ness avenue and Chestnut street line will be begun August 15th with the first 25 cars, the construction of this line being ahead of schedule time, which fixed its completion and operation for September 1st. Assistant Engineer Ransom says that the Potrero avenue and Eleventh street line will be ready probably on September 1st, a month ahead of the time set.

RED BLUFF, CAL.—Suit has been filed by H. C. Hendricks against the Sacramento Valley Electric Railway Company to cancel a note for \$1500 for the purchase of stock in the company. This suit was brought as a test case. Its decision may affect holdings to the extent of \$100,000. Hendricks claims that the note was given for stock purchased on the understanding that work on the road would not be commenced until sufficient money was in the company's treasury to build the line from start to finish. The company having let a contract for a 12½ mile unit, from Dixon south, at a time when the funds in the treasury are not sufficient to allow of further construction work being done, Hendricks claims this in violation of the understanding. An injunction is now in progress in the Superior Court of San Francisco, against the railroad to restrain it from building the Dixon unit. This action was brought by Z. P. Dyer.

OGDEN, UTAH.—The Ogden Rapid Transit Company has awarded the contract for the line material and electrical equipment necessary for the electrification of the extension of its interurban line north from Brigham City to Preston, Idaho. The electrical equipment of the substation and the cars was awarded to the Westinghouse Electric & Manufacturing Company with district offices in Salt Lake City. Fifteen hundred volts direct current equipment will be used. The contract for the line material was awarded to the Ohio Brass Company, represented in Salt Lake City by Mr. Frank B. Cook. This 96 mile extension of the Ogden Rapid Transit Company north from Ogden to Preston, Idaho, will connect at Ogden with the Salt Lake & Ogden Railway Company, better known as the Bamberger line which has been operating by electricity between Salt Lake City and Ogden, a distance of 36 miles during the past three years. At Salt Lake City the Salt Lake & Ogden Railroad connects through a Union Depot with the Orem line, running south of Salt Lake City to Provo, a distance of 50 miles. The Orem line is now being equipped with Westinghouse electrical equipment using 1500 volt direct current also. The Orem line will next year extend its terminus from Provo south to Payson, a distance of 20 miles further, so that when this system is completed and in operation the state of Utah will be traversed from north to south, a distance of over 200 miles, with high speed interurban electric lines.

TELEPHONE AND TELEGRAPH.

OLYMPIA, WASH.—The State Minimum Wage Commission has adopted the recent conference recommendation of \$9 a week as the minimum for telephone girls throughout the state.

BOLINAS, CAL.—Contractors have completed construction of the Marconi wireless telegraph station, a short distance from town. This is the sending station for the Marin county unit of the system, the receiving station being located at Marshall's, sixteen miles away. Included in the equipment of the local station is a 500 h.p. motor. Messages will be sent and received largely between this point and the Honolulu station, which has also been completed. The two plants of the system represent an investment of upward of \$500,000. They are being tested out prior to going into regular service some time about July 20th. The Marin county station is a unit in the system, which will comprise eleven stations, located at various intervals over the circumference of the globe.

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BY C. O. WILSON.

AUTOMATIC ELECTRIC OPERATION OF OIL WELLS.

THE THERMO RELAY.

BY B. B. BECKETT.

ELECTRIC PUMPING OF OIL WELLS.

BY RALPH ARNOLD AND V. R. GARFIAS.

THE TELEPHONE PROBLEM.

BY D. P. FULLERTON.

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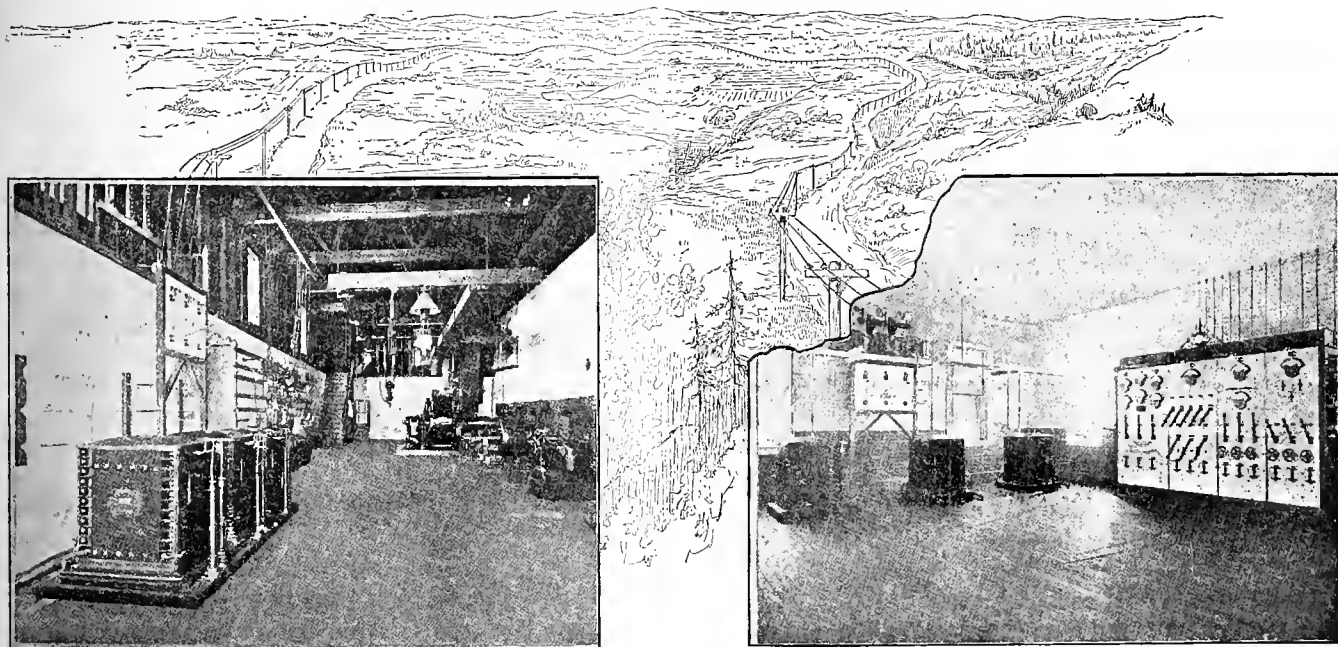
HISTORY OF ELECTRICAL TRANSMISSION

BY G. O. WILSON.

(This series of articles traces the early history of the transmission of energy from its infancy until 1900. Subsequent progress is briefly summarized. They represent the painstaking studies of the author while a student at Stanford University, he now being associated with the engineering department of the Standard Oil Company of California.—The Editor.)

The transmission of mechanical energy to a distance, by the expedient of converting it into electrical energy at the point of generation, and reconvertng it into mechanical energy at the point of application, dates from the famous experiment, or accident, of Gramme and Fontaine at the Vienna Exposition in 1873. Accounts of this experiment differ widely; but a comparison of the most authentic seems to indicate

Gramme has been generally honored as the father of the electrical transmission of energy. His right to this title was challenged in 1891 by A. M. Tanner, who published a series of articles in the London "Electrical Review" of that year purporting to show that the system had been known to several other scientists before 1873. He said that Professor Jacobi mentioned the scheme as being perfectly possible, in



10,000 Volt Transmission System Installed in 1896 by the Redlands Light & Power Company Between the Mill Creek Power House and the City of Redlands.

that the discovery was purely an accident. One of the Gramme dynamos at the exposition was running, and an attendant unknowingly connected it to a circuit to which was connected an exactly similar dynamo at rest. This second machine started turning in the opposite direction from the one already running—and electrical transmission of energy was an accomplished fact.

This first motor was successfully used for operating a pump and doing various small bits of work about the exposition, and as a result of these experiments,

a memoir which he published in 1850; that Dr. Sin-stedden described an experiment similar to that of Gramme's in the "Analen der Physic" in 1851; and that Professor Pfaundler of Innsbruck mentioned the possibility of the process in 1867 and carried out experiments to prove his theory in 1870. The "Electrical World" of New York, Vol. 2, 1883, brought forth a claimant to early honors in the person of Dr. Antonio Pacinotti, who described the principle of the reversibility of the dynamo in an article in "Il Nuovo Cimento" for June, 1864. Tanner also cited a French

patent, No. 2214, issued to one Henry Gilbie in 1855, describing transmission of electricity to a distance and methods of utilizing it in cars; and another French patent issued to Cazal in 1864, which described a dynamo driven by a windmill, the current from which was used to operate motors driving cars. Gilbie is quoted as expressly stating that the invention was not his, but was the product of Alexander Besolo, and Tanner consequently names Besolo as the father of electric transmission. But the work of all of these men either never got beyond the patent drawings and models, or was of a purely laboratory character, insignificant in size of machines and amount of work done, and Gramme and his collaborator Fontaine seem to deserve the honor of being named the first to have demonstrated the possibility of employing the electric current to transmit mechanical energy from one place to another.

The date of the first commercial use of electricity as a motive power is also rather obscure. Here again Tanner brings forward a very early claimant, stating that Eugene Regnault in 1858 was the first man to utilize electric power for driving a commercial machine. The first definitely described application was in the Artillery Works of St. Thomas d'Aquin. In this shop there was an accurate dividing machine driven by an electric motor which derived its current from an adjacent storage battery; under the orders of the president of the French committee on artillery, the battery was replaced by a Gramme generator placed in another part of the shop, and driven from one of the main shafts. The "transmission line" from motor to generator was 200 meters long; and the installation was described as saving much trouble in comparison with the storage battery plant.

Another so-called "first commercial application of electricity" was at Sermaize, France, where a motor drawing current from a Gramme generator was used in 1878 to run a hoist at a beet sugar works; and still another was at Shaws Water Chemical Works, England, where in 1878 a water-fall behind the works was caused to drive a Gramme generator, which transmitted "through the various departments of the works to a motor in the engineer's shop 150 yards distant, this motor being used to drive various small saws, mills, and the like." The French installation at the artillery works seems, however, to be the first authentic commercial example of the transmission of energy by means of the electric current.

A Frenchman was also the first to investigate the problems of distances measured in miles rather than yards. About 1880 M. Marcel Deprez brought forward a theory that the efficiency of electrical transmission was fifty per cent, regardless of the length of the transmission line. He worked out an elaborate mathematical proof in support of this theory, which attracted great attention.

In order to give him an opportunity to demonstrate his proposition, the authorities of the Munich exposition in 1881 asked him to set up a model transmission plant from Munich to Meissbach, a town 37 miles distant. This he immediately set out to do; and for the purpose of accurately and simultaneously measuring the electrical quantities at the two ends

of the line, he decided to place generator and motor in the same room at Munich, connecting one pair of terminals by the long loop of wire from Munich to Meissbach and return, and the other pair by a short wire. Considering that the resistance of the loop, which was of iron telegraph wire, was about 900 ohms, and of each of the armatures was 460 ohms, Deprez achieved a high efficiency in this first long distance transmission. He brought his results forward as proof of his theory, and they were accepted as such by the French Academy; but the English engineers attacked the validity of these results because, as they pointed out, the short connecting wire between the machines was not earthed, and as a result, leakage from the wires of the loop increased rather than reduced the efficiency. To this Deprez replied that the line had been tested for leakage, and it was found to be less than two per cent; but M. Hospitallier pointed out that this measurement of leakage was worthless, for it was made in dry weather, and with low impressed voltage; while the transmission experiment was carried out in a heavy rain, and with a direct voltage of over 2000 volts.

Deprez was, however, warmly supported by Hertz, the editor of *La Lumiere Electrique*, and with this encouragement, and financial backing furnished by the Rothchilds, who had become interested, he began in 1884 the preparations for a much larger project, the transmission of power from Criel 24 miles to Paris. He designed a direct current generator to deliver 20 amperes at 7500 volts, and a similar machine to be used as a motor. He placed both machines in the same room, as at Munich, claiming that the objections of the English engineers to such a loop system were swept away by the fact that accurate measurements of leakage and resistance of the line were taken at the time of performing the experiment, but overlooking the fact that these measurements were made with low voltage. The wires of the 48 mile loop were of phosphor bronze, wrapped in hemp soaked in resin oil, and enclosed at first in lead tube. On account of the fact that this lead tube proved to be of little value as protection against mechanical accident, while its condenser action was a serious detriment, it was subsequently removed. The line suffered from many serious accidents; trees fell against it, it was shorted onto other lines and to ground, and other troubles beset the promoters. But finally, in 1886, Deprez proudly brought forth his results, which purported to show that the transmission had been successfully accomplished with an electrical yield, based on the voltage ratios at the ends of the line, of 77 per cent and a mechanical yield, based on dynamometer readings on the generator and motor, of from 47 to 53.4 per cent.

These results were again bitterly attacked by the English engineers, because of the use of the un-earthed loop, and because of the prohibitive cost of the experiment necessary to handle such a relatively small amount of power. M. Hospitallier tersely remarked that "a costly plant had been erected for the purpose of transmitting 100 horsepower from Criel to Paris, and had only succeeded in transmitting 40 horsepower from Criel—to Criel." Viewed in the light

of present day transmission practice, Deprez' experiments were of an utterly useless character; the resistances he employed were ridiculously high, and his cost per horsepower transmitted was prohibitive. But it must be remembered that he was an absolute pioneer in the field, and much credit is due him for even the unsatisfactory beginning, which he succeeded in making of the solution of the problem of transmission.

While these experiments, interesting from a scientific point of view, but fruitless as a demonstration of the commercial possibilities of electricity, were being carried on, engineers throughout the world were studying the relative merits of the various systems of power transmission in vogue, and electricity was being given many opportunities to demonstrate its superiority over compressed air, steam, or belts. In Switzerland, the first long distance transmission was installed at Turin in 1884, power for 60 incandescent lamps being transmitted $6\frac{1}{4}$ miles to Lanzo at the high direct voltage of 10,000 volts, obtained by connecting several generators in series.

A much larger plant, in which 250 horsepower was generated hydraulically, was installed in 1886; from this plant 60 h.p. was transmitted 2 miles at 1000 volts d.c., and used at the receiving end for driving motors, and the rest of the power was transmitted $3\frac{1}{2}$ miles at 1800 to 2000 volts a.c., single-phase, and used for lighting. This separation of the loads according to the class of service was typical of the electrical industry before the introduction of multi-phase alternating currents and motors.

The inapplicability of the alternating current to power work in these early days was the underlying cause of the rapid development of the direct current system in Europe; and it is perhaps because large power development in the United States did not begin until after the introduction of alternating current motors that the alternating practice has always been almost universal in this country. The first use of alternating current for power and light on the same circuit was when a generator was installed in Austria-Hungary in 1889, 25 amperes being transmitted $1\frac{1}{2}$ miles at 2000 volts.

The high cost of fuel for the operation of mines in New Zealand and Australia, and the abundance of water power in those countries, led to the early development of electrical power there. The first plant was installed in New Zealand in 1885, power to operate 20 stamp mills being generated at a waterfall 2 miles from the mine, and transmitted on copper telegraph wire. A larger plant was installed in 1886, 53 h.p. being transmitted 3 miles on No. 8 B. W. G. wires at 2000 volts d.c. The generators of this power were connected in parallel, this being the earliest record of such connection.

Mines were the scenes of early installations in other parts of the world as well. One of the first power plants installed in the United States was the one at the bottom of a 1650 ft. shaft in a mine in the famous Comstock district, completed in 1889, where 780 h.p. direct current was generated and transmitted up the shaft and along the surface one mile to the stamp mills. The only earlier plant of notable size

in the United States was in Boston; in 1885 the largest generator in the country was installed there, and the 300 amperes which it delivered at 123 volts were carried three-quarters of a mile over the house-tops.

During these years, some startling claims were made for the commercial possibilities of electric power plants. All the articles dealing with this question began their discussion by assuming that the company could safely contract, on the horsepower year basis, for double the power capacity of its station. With this generous assumption, and the high rate of \$125-\$150 per h.p. year for the energy, which was evidently the prevailing price for steam power, net profits from 65 to 150 per cent per year were claimed to be easily returnable from an electric plant. The first man who realized that contracts covering 200 per cent of the capacity of the plant were too large was Frank J. Sprague, who read a paper before the Franklin Institute in 1889, stating that the power contracted for might be "somewhat above the capacity of the station."

In the early nineties, three projects in different parts of the world were typical of the highest development of the electrical art at the time. In Europe, the transmission of about 200 h.p. of electrical energy from Lauffen to the electrical exhibition at Frankfort, a distance of 110 miles, was the greatest triumph in the world at that time. The generator at Lauffen was a Brown three-phaser, Y-connected with neutral grounded, having a voltage from each line to neutral of from 45 to 60 volts, "depending on the amount of power leaving the station." This was stepped up, in transformers having a ratio of 160:1, to a line voltage of 12,000 to 16,000. The transmission wires were of hard-drawn copper 160 mils in diameter; they were carried on oil insulators, mounted on poles about 26 ft. high and 200 ft. apart. At the exposition, the power was used to drive a 110 h.p. motor belted to a centrifugal pump which produced an artificial waterfall, and to light 1100 sixteen c.p. lamps.

The plant was so up-to-date in most of its details, that the method of operating seems strikingly obsolete. Leaving the Lauffen station, the line wires were first carried to two poles close together, between which the current in each line passed through fuses. When the operator at Frankfort desired to have the plant at Lauffen shut down, he lowered a heavy short-circuiting bar across his lines at the Exposition; this of course blew the fuses at Lauffen, causing the turbines to race, and the operator to shut down. After the generators were stopped, the Lauffen operator would replace the fuses, and connect a telephone to the line, establishing communication to Frankfort and learning from the operator there when to start up again.

The efficiency of the transmission from generator shaft to motor shaft was about 74 per cent. This high figure led the engineers of the day to hail the project as a magnificent success, removing the last doubts of the feasibility of long distance transmission. But the fact was evidently overlooked at this time that the energy thus delivered to Frankfort cost about five

times as much as it would have if generated in the city with steam power.

In England, the greatest electrical project of this period was the Deptford Central Station, for supplying power to London, 14 miles away. This was of course a much shorter transmission than at Frankfort, but the power transmitted was enormously greater. The project was launched in 1888, and placed under the supervision of the engineer, Ferranti. After several years of hard work, disappointments, and deferred promises, it was finally put into operation in 1891. The original plant contained two 1500 h.p. and 625 h.p. single-phase Ferranti alternators. At the time of starting, a 10,000 h.p. unit of enormous size was planned as the first addition, but this was evidently never installed, for a description of the station written in 1895, spoke of the "new machines of 1000 kw. capacity."

The plant labored under great difficulties at the start. A disastrous fire as the result of an arc at the Grosvenor Galleries substation shook public confidence in the feasibility of the high transmission voltage, 10,000 volts. Ferranti was forced out of the company and out of England. The voltage was reduced to 5000, with corresponding loss of efficiency. In 1895, however, all these early difficulties had been overcome; for the above-mentioned account of the station written at that time described an enlarged plant operating successfully at 10,000 volts.

While these projects at Frankfort and Deptford were the most prominent examples of electrical power transmission on the continent and in England, respectively, many other projects of almost equal importance were being constructed during the early nineties. After the close of the Frankfort exposition, the power generated at Lauffen was transmitted six miles to Heilbron at 5000 volts. In Italy, transmission of power from Tivoli to Rome, a distance of 17 miles, was accomplished in 1892. This marked the successful completion of an early development of power in Rome; for the steam plant constructed there in 1896 was the first a.c. central station operating at high voltage with an underground distributing system, and transformers connected in parallel. Two alternators of 150 h.p. each were installed at this time. About the same time a small local hydraulic plant was built at Tivoli, and enlarged in 1888. When the demands of the Roman steam plant became too great, it was decided to further enlarge the hydraulic development at Tivoli, and connect this station with the one at Rome. Six generators, delivering 42 amps. at 5100 volts, giving a total capacity of about 1250 k.v.a., were installed, and the seventeen mile transmission line was completed and put into operation in 1892. The efficiency of the transmission system was described as 80 per cent.

In France, a hydraulic plant of 300 h.p., transmitting nine miles from Rivel to Domene was in operation in 1891, and enlargement to 2000 h.p. was contemplated. Early in 1894 a plant generating 600 kw. was completed at Chambéry, the power being transmitted 11 miles.

In Switzerland, the great abundance of water power led to the early development of a large number

of small hydraulic plants, delivering power over a radius of a few miles. In 1893 the longest transmission line in Switzerland was the 17.2 mile line carrying power from a hydraulic plant to Biberist, 262 h.p. being transmitted at 5000 to 6000 volts d.c., at an efficiency of 85 per cent. A much larger plant was completed in 1895, 1285 kw. being transmitted from Locle to La Chauz-de-Fonds, a distance of 28.8 miles, at 14,400 volts d.c. These two large plants, as well as most all the small ones, were operated on the Thury direct current series system. In fact, the great Swiss engineer who perfected this system had such a wide influence in his native country that a majority of its transmission lines even today are operated on the Thury system, in spite of the advantages of three-phase operation which American practice has demonstrated.

In America, the first long distance transmission line was built at San Antonio, in Southern California, in 1892. On this line 800 h.p. was transmitted 28 miles at 10,000 volts, the current all being used for lighting. Another installation in this year was at a mine at Ouray, Colorado. The power transmitted was much less, and the distance four miles shorter than at San Antonio; but the rugged character of the country through which the line was built, a great deal of it being above the timber line in the Rockies, marks it as one of the achievements of the electrical development of this country. Another Colorado plant built in 1892 was the three mile line built to the mine of the San Miguel Consolidated Mining Company, at Telluride, 120 kw. being transmitted over this line at 3000 volts, single-phase.

As noted above, the San Antonio plant transmitted current for lighting only; the first long distance line in America for joint power and lighting purposes was from Mill Creek to Redlands, Southern California, where in 1893, 500 kw. was transmitted $7\frac{1}{2}$ miles at 2500 volts, 3-phase. This was the first 3-phase plant in the United States; before the end of the same year, another was installed at Hartford, Connecticut, where 300 kw. was transmitted 11 miles at 5000 volts. This latter plant was built to replace the single-phase plant that had been delivering power for lighting over the same line since 1891.

[To be continued.]

Portable electric lamps are finding increasing favor for use in mines. The U. S. Bureau of mines recently investigated a number of lamps submitted for the purpose of establishing their safety and has approved of three of them for use in gaseous mines. The Bureau's proposed specification for minimum performance call for an intensity of 0.4 c.p. at all times with a flux of 3 lumens for hand lamps and 1.5 lumens for cap lamps to be maintained for 12 hours per charge. The bulbs should not vary more than 15 per cent below the average candlepower nor consume more than 10 per cent above the average current consumption, having an average life of 300 hours for primary batteries and acid storage batteries and of 200 hours for alkaline storage batteries. These batteries should have an average life of 3600 hours and 7200 hours respectively.

AUTOMATIC ELECTRIC OPERATION OF OIL WELLS.

(An interesting description of the satisfactory replacement of steam and gas power by electric motors for the operation of oil wells is here given. We are indebted for the text and cuts to the San Joaquin Light & Power Corporation, from whose magazine the article is taken.—The Editor.)

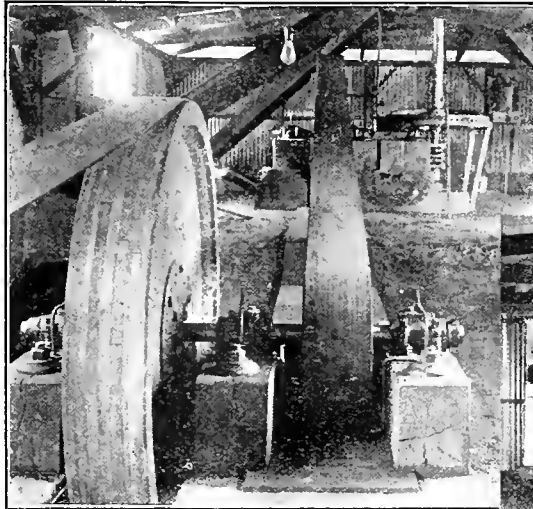
With the adoption of electricity as a motive power on the leases in the Kern River oil fields of California, there has come about a gradually increasing efficiency in the operation of these properties and a corresponding decrease in operation costs. A greater economy and much more simplified methods of conducting the work necessary on an oil lease are permitted by the electric drive. Improvements have been continually advanced until the state of automatic op-

eration has been practically reached. Save for the services of one man whose work it is to make the rounds of the property to see that all cables are intact, the oiling devices are working properly and no parts are out of order, there is an oil property in the Kern River fields that is as near automatic operation as is possible to be.

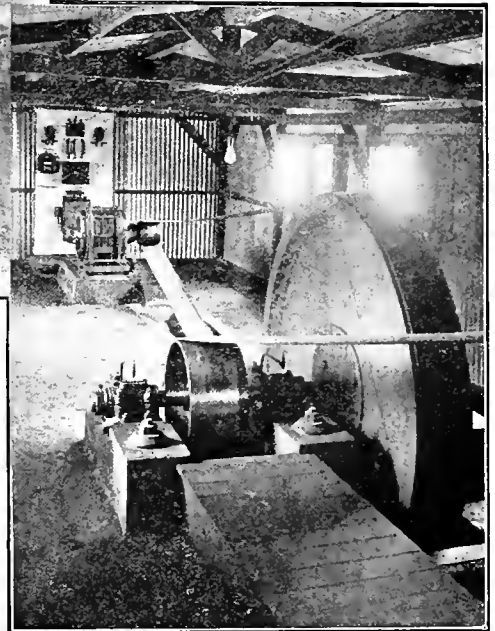
This is the Central Point Division and Red Banks property of the Associated Oil Company. A 35 h.p. motor is operating a pumping jack by means of which sixteen wells and a line pump are being worked, and from this one central power station all of the energy necessary to raise the oil to the surface and conduct it to its place of disposition, is provided by the simple act of turning on an electric switch. After being raised out of the ground, the oil is automatically handled through a pipe line and heating plant. The production end is equally as simple, as an automatic oiling device does away with the attendance of oilers and pumpers, firemen and engineers, and except for



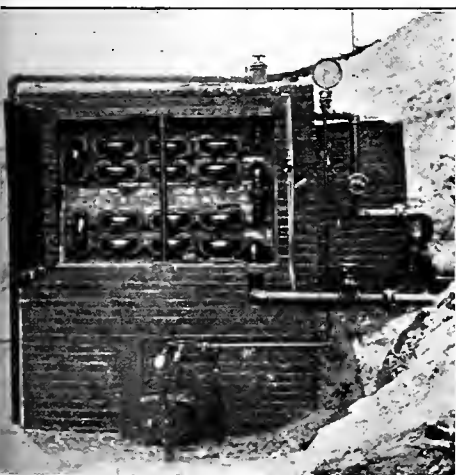
Pumping Jack Which Automatically Pumps an Oil Well.



Interior of Jack House, showing belt drive, jack shaft and automatic oil distribution. The supply tank is on wall at the right and feed pipes may be seen above bearings.



Interior of Motor House, Showing Electric Drive and Switch Control.



Gas Burning Heating Furnace Showing Pipes Through Which the Oil Enters and Departs.



Butterfly for Regulating Pumping Jacks.

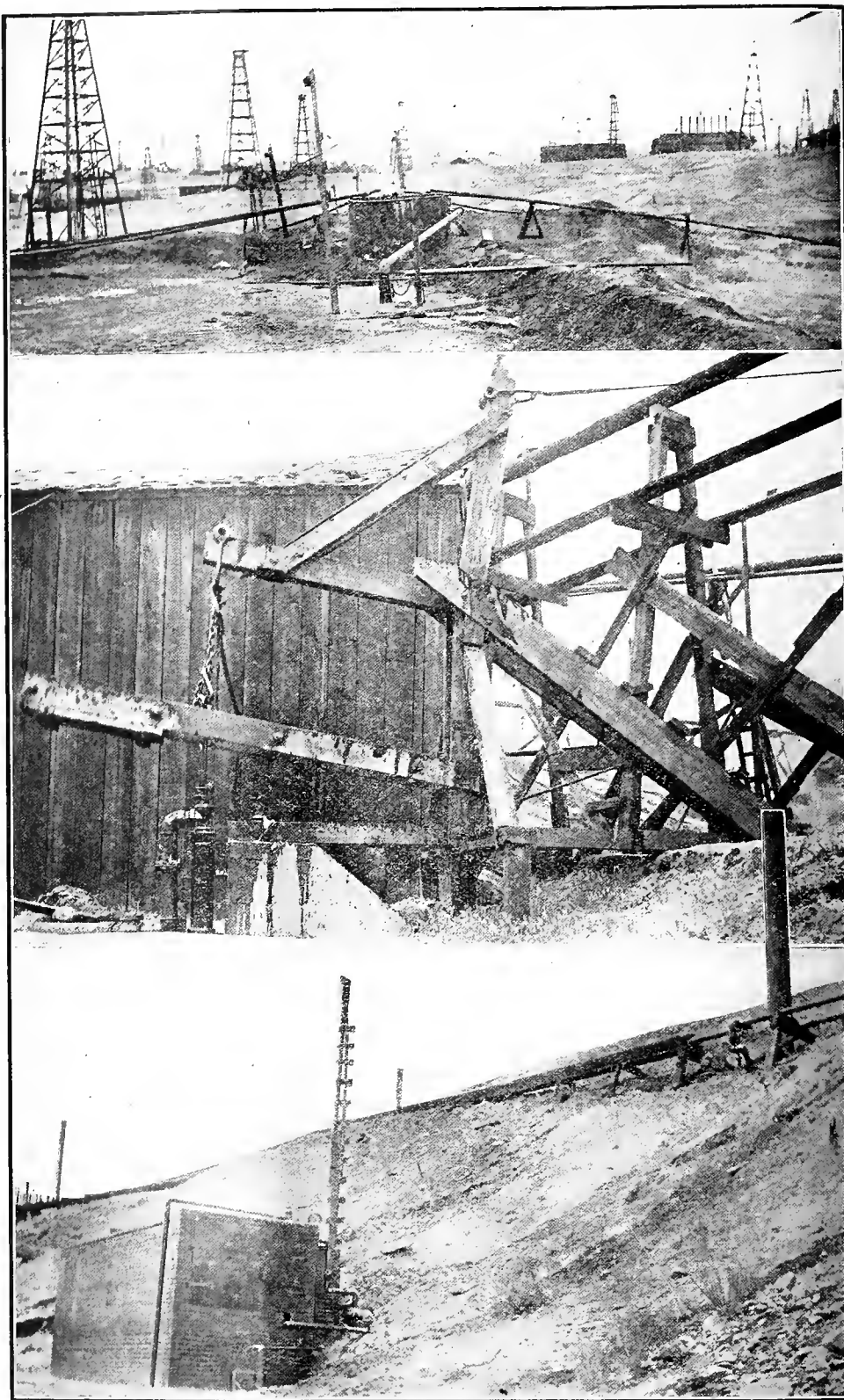
the services of a man to apply oil to the eccentric on the jack once a day, the lease could go on operating day in and day out without any attention whatever.

To persons familiar with the old method of operating oil leases, with the extravagant wastes of steam and the resultant high cost of production, the simple and inexpensive operation of this Associated Oil Company property is a revelation. Instead of it being necessary to maintain two crews of men for the operation of the steam boiler plants

and two crews of oilers and pumpers, meaning in all the employment of from eight to twelve men for a lease of this size, according to the number of wells they are individually assigned to handle, all of the work is now automatically done by the motor. The big steam plant which developed 340 h.p. is now standing idle, while a little motor of about one-tenth that capacity is now supplying the energy to conduct the operation of the property. At one time in the history of this lease, the jack was operated by a gasoline engine but it was discarded in favor of the electric motor.

This ideal condition of operation is made possible by the introduction of the pumping jack. The jack is a power head, built on the theory of an eccentric that is generally situated in the middle of a group of wells, and at different points on the eccentric yoke cable lines are connected and each in turn is tied to a rocker beam at the well head. While it may be operated by steam or gasoline engines and electric motors, operation by electric motor is far more economical and satisfactory and affords a saving in expense equally as much, if not more, as is made by the individual oil well motor. The ordinary constant speed motor can be used to operate a jack. It is generally connected to the jack shaft through a friction clutch, in some instances driving the friction clutch by a Morris chain drive, but more commonly with the ordinary leather belt. The outfit is simple and the installation very cheap as no special electrical apparatus is required other than the ordinary constant speed motor.

The jack and motor are housed in the same building, the motor at one end and the jack at the other. The type of jack employed on the Central Point property is known as the Fulton power jack and is operated by means of gears on the counter shaft and two eccentrics on the top of the shaft which extends through the roof of the jack house. To these eccentrics jack lines, or aerial cables, are attached and strung through the air by means of small pole lines to the oil wells to be operated. Although it is



Upper view shows oil leaving well and flowing into receiving tank, from which it gravitates to settling tank housed in building in middle picture. Here it is pumped through line to gas heater, shown in lower picture, and on to storage tanks.

designed that the jack is to be in the center of a group of wells, the cables are often from 150 to 1000 feet in length and occasionally some wells are as far distant as a half of a mile from the power station. Any number of wells can be connected up in this way, provided sufficient motor power is provided to handle them. With so many lines working from the two eccentrics it is necessary to balance the power

so as to get the load on the four corners with the minimum amount of horsepower, and in order to do this "butterflies" are constructed. These are huge poles which divert certain of the cables at an angle sufficient to equalize the load in all directions.

Pumps for forcing oil through the pipe lines, as well as raising it out of the wells, are also connected to the jack and in this manner it is possible to produce the oil and transport it from the property in one and the same operation. Rocker beams are placed over the well heads and pump heads, and the action of the eccentrics works the beams back and forth, thus giving the pumps the necessary play.

With the starting up of the motor all of the wells and pumps connected to the jack shaft are started at work, and thereafter there is but little need of attention. The work of the oilers is disposed of by an automatic oiling system installed in the jack house. The oil is gravitated through all of the bearings of the motor drive and jack shaft, and the waste is drawn off into a small basin on the side, from which it is utilized to oil the eccentrics. It is necessary for a man to perform this operation once a day.

To fully understand the automatic operation of the lease, following the oil in its course from the well to the shipping track will assist. The oil is delivered from the wells into sumps of small delivery tanks from which it is gravitated to a large settling tank. Here a 6 inch pump, which is operated by means of the jack, forces it into the delivery pipe line under about 20 pounds of pressure. On the way, however, it automatically passes through a gas heating furnace, which increases the temperature so as to make it flow readily, a condition necessary for the free transportation of petroleum of heavy gravity and particularly so during the winter months. The pressure supplied by the jack pump is sufficient to run it into the furnace and out again, and thence on through the line to a 14,000 barrel concrete storage reservoir at a far end of the property where it is contained until ready for shipment. It is then run by gravity out into shipping tanks and measured either into tank cars or tank wagons as the case may be.

In connection with the automatic operation of this lease, the heating furnace is of particular interest. The furnace is built on the hillside considerably lower than the pipe line. It is fired by natural gas obtained from the wells on the property and two gas pumps keep up the pressure necessary to feed the furnace. The inlet pipe is $5\frac{3}{8}$ inches in diameter and is conveyed to the furnace through the flue, which is buried beneath the surface of the ground along the hillside so as to give the oil entering the furnace the benefit of the stack temperature. The oil then goes through 640 ft. of 3-inch coils, passing out of the furnace through a 3 in. outlet pipe after having attained the temperature of 200 degrees. No further pressure is necessary in its transit to the big storage tank and in this movement it loses but 3 degrees in its furnace temperature.

The furnace is a type of many similar furnaces erected throughout the field for this purpose and is ideal in its construction. The coils are divided into four rows, each containing an equal length and by

means of a perforated arch the first two rows are heated first. The heat is then conveyed to the rear end of the furnace by means of a baffle plate and then brought to the front over the remaining two rows of coils. The furnace is capable of generating 1000 degrees of heat, but it is so perfectly utilized that the stack temperature does not vary beyond 160 to 180 degrees.

The temperature of the oil as it is taken from the wells varies from 50 to 60 degrees in winter, to 100 degrees in summer. It is of heavy gravity, the only quality produced in the Kern River field, and requires additional heat before it can be easily handled. The temperature is generally raised to 200 degrees, at which figure it is most easily worked with. The problem of heating oil has always been before the operators and at times it has proven very costly. This automatic gas burning furnace requires the attention of no firemen or other attendant, the gas pumps always maintaining the pressure necessary. The furnace will heat 1000 barrels of oil daily, although under the present conditions about 600 barrels are being heated.

The Central Point Division and Red Banks is held out as a model of an electrically equipped lease. The results attained have been eminently satisfactory, the daily cost of operating the producing wells having been reduced to a minimum.

The installation was made under the supervision of Charles L. Easton, electrical superintendent of the Bakersfield district of the San Joaquin Light & Power Corporation, and its successful operation is a source of gratitude to him as it upholds a theory he has been working along since the introduction of electricity on oil leases was first undertaken. This property is now a show place and operators interested in the motor drive are constantly visiting it to inspect electricity in practical operation.

The electrical feature of the operation of the property is in charge of W. M. Thurston, chief electrician for the Associated Oil Company, in the Kern River fields, and he and Mr. Easton worked hand in hand in developing many of the ideas that were used in the final equipping of the lease.

Panama Canal toll on cargo tonnage is \$1.20 per net ton of 100 cu. ft.; the tolls collectible on the net ballast tonnage is 60 per cent of the net cargo tonnage charge.

Electrical seasoning of timber is being successfully employed in Australia by the Alcock Proprietary, Ltd., manufacturers of billiard tables. An electric current is passed through the wood, the sap acting as a conductor, for from four to eight hours, depending upon the length and thickness of the wood. Timber 1x12 ft. can be seasoned in eight hours, but must be stacked four or five months after treatment, so as to dry out all moisture. Natural seasoning requires four or five years' stacking, and the loss through warping and other causes is about 25 per cent. With the electrical process the loss is less than 10 per cent. Blackwood and mountain ash are the woods employed, the greener the timber the better the results.

ELECTRIC PUMPING OF OIL WELLS.

BY RALPH ARNOLD AND V. R. GARFAS.

(This information is abstracted from Technical Paper No. 70 of the U. S. Bureau of Mines, entitled "Methods of Oil Recovery in California." The original paper also gives information on the use of steam, gas and oil power in the California fields—The Editor.)

The situation of many of the oil fields of California near the Sierra Nevada Mountains, where perennial streams are the source of electric power, accounts for the wide use of electricity throughout the San Joaquin Valley fields. The Sierra Nevada forms the eastern rim of the valley, and the oil fields are situated on the western edge of this depression, between the mountains and the important cities on the coast. The situation of the fields greatly facilitates the transmission of the current and lessens the expense for the proper looping of the lines. A 60,000-volt loop starts from a substation in the San Joaquin Valley and runs through the Coalinga, Lost Hills, Belridge, McKittrick, Midway, and Kern River fields, thence north to the point of beginning, a distance of 370 miles. The secondary lines in the oil fields are three-wire lines, and supply three-phase current; commonly there is a fourth line for neutral, the voltage being 11,000 volts between main lines and 6600 to neutral. These lines are often ended in loops in the fields, having pole-top switches about every three miles, thus allowing the segregation and elimination of any section in trouble and continued service to other sections.

For steady pumping under normal conditions the power for electric motors for direct pump drive of oil wells should usually average 3 to 5 h.p. For very deep wells or for special conditions 6 or 8 h.p. may be needed.

The usual pumping speed is about 20 strokes per minute, but, owing to the need of increasing the speed when shaking up the oil, as high as 30 strokes per minute may be necessary. For cleaning the well, as compared with normal pumping, about double the speed and from three to four times the power is required.

In the oil fields as a whole three or four kinds of electric motors are in use, all of the alternating current, induction type.

The Single-Speed Motor.

The single-speed motor, with the standard squirrel-cage rotor, may be first considered. This motor operates at one speed only, and its highest efficiency is reached when it has nearly a full normal load. In common with motors of all types, the current density may, for a short time, be increased somewhat beyond the safe value for continuous service, and thus the short-time (one-half hour, for example,) power capacity of the motor may be correspondingly increased over normal rating.

Changes in speed and power may be obtained with this motor by introducing one or more of three special features, as follows:

(a) By suitable connections on the frame of the motor, the magnetic poles may be combined in groups of two, or used singly, as in the standard type. In this way the motor may be made to operate with the full number of poles or with half that number. The latter arrangement will result in doubling the speed. In this

way a speed ratio of 2 to 1 is realized, and with the same torque, 2-to-1 ratio for power.

(b) By using a wound rotor instead of the squirrel-cage construction, and bringing current to the rotor through slip rings, it becomes possible, by introducing a variable resistance into the rotor circuit, to realize a close step-by-step speed variation covering the range of, say, 50 per cent to full speed, there being corresponding changes in power.

(c) By making the field connections in such manner that the coils can be thrown into either a delta or Y connection, the power of the motor at the same speed and under the same general current density will be increased for the delta connection to a value about 1.7 times its value for the Y connection. Furthermore, by suitable design as to current capacity of coils and conductors, the current density may be increased readily in the ratio of 1.732 to 1 or even 2 to 1. This arrangement will assure a total power change in the ratio of 3 or more to 1. Thus with the Y connection the motor may be designed to operate with high efficiency on a steady pumping load of 4 to 7 h.p., and then, by a throw of the switch, it becomes capable of carrying 20 to 25 h.p. with good efficiency for such period as may be required.

The use of special feature a alone gives the double-rated, two-speed motor. The combination of a and b gives the double-rated, two-speed, variable-speed motor. The use of b and c in combination gives the double-rated, single-speed, variable-speed motor.

The single-speed motor is suitable only for conditions permitting a constant speed and a nearly uniform power output. Such conditions are found in driving a number of jacks or in pumping an old well at a single speed and without cleaning. The principal use of such motors is for the driving of pumping jacks.

The Double-Speed Motor.

The double-speed motor a has the inherent simplicity and reliability of the single-speed type, with the added feature of two practically constant economic speeds in the ratio of 2 to 1. It has no slip rings that may spark and ignite escaping gases, and its first cost is somewhat lower than that of variable-speed motors.

On the other hand, the speed of operation, as for pumping, does not admit of close step-wise change. The motor has two speeds in the ratio of 2 to 1, and to obtain any other variation in the speed of the pump or other driven machinery such mechanical means as pulleys or gears must be used. These motors have been found to give effective service at old wells, where one fixed speed can be used for pumping and another (the double) for cleaning.

The Variable-Speed Motor.

The variable-speed motors a combined with b, and b combined with c, as noted, require slip rings; and these, if not in good mechanical condition, may cause sparking and resulting danger of fire in case gas escapes about the well. With proper housing and protection, however, this feature has not been found serious. The first cost of such motors is, of course, somewhat more than that of single or double-speed motors. The great advantage of such motors is the graduated change of speed obtainable through the variable external resistance, and in the power change, either

through the delta or Y line connection c, or through the pole-changing device a. As previously stated, they are the only motors that can be considered as fairly meeting the various requirements of well-pumping service.

As between the two combination motors, the two-speed variable-speed motor a combined with b has the advantages of power variation over a range of 3 or 4 to 1, and of a speed variation of 40 to 50 per cent from two-base speeds, whereas the motor b combined with c has the same general advantage of power variation, but gives speed variation from one-base speed only. With the latter motor a pulley change is required in order to obtain double speed for cleaning.

With the motor a combined with b no pulley change is required—all speed changes necessary are provided for in the construction of the motor. The speed change may be closely graduated from two-base speeds to cover the wide power range between pumping and cleaning. With such a motor the various power requirements at the well, once the drilling is completed, can be met effectively and reliably.

A typical motor of this type for wells 600 to 1200 ft. deep is rated at 7 h.p. for continuous pumping service. Ordinarily 3 to 5 h.p. will be required for a speed of 600 revolutions per minute, or enough to give about 20 strokes per minute. For cleaning or other special service, the switch is thrown over, when the motor will carry 20 h.p. at 1200 revolutions per minute. For heavier work, motors of 10, 25, 30 and 50 h.p. are now being manufactured.

For speed reduction, the motors for most wells are belted to a countershaft and thence to a large pulley; or, if a steam engine is to be displaced, the crank shaft and wheels of the engine may be used for a countershaft.

Cost of Pumping by Electric Power.

The actual expenditure of electric energy for pumping varies widely. The average used in 71 wells, each about 1600 ft. deep, over a period of time for which records were kept, was 70.6 kw.-hrs. a day, which, at $1\frac{1}{2}$ cents a kw.-hr., made the daily cost for pumping per well a trifle over \$1.05. The deepest well, 2692 ft., used about 90 kw.-hrs. daily.

In another instance the average for two months for 8 wells varying in depth from 1000 to 2800 ft., was 93 kw.-hrs. a day. In another instance the average for 12 wells, averaging 1100 ft. in depth, with oil of a specific gravity of 0.9622 (15.5° B.), was 71.5 kw.-hrs. a day. The average for another group of 107 wells, averaging 800 ft. in depth, with oil of a specific gravity of 0.9756 (13.5° B.), was 57 kw.-hrs. a day. In another instance, with 58 wells pumped by three motor-driven jacks, the average per well a day was 26.2 kw.-hrs. For another group of some 220 wells operated by jacks, the cost of electric energy per well per month varied from \$6 to \$14.40.

Electric power in the field is sold at varying prices, the common figure being about 1.5 cents per kw.-hr.

An electrically equipped hospital car complete in every detail is used on Swiss railways. The electrical energy required is supplied by a generator mounted on one axle.

LETTERS TO THE EDITOR.

Answer to Col. H. D. Loveland.

To the Editor:

In your issue of July 4, 1914, you published a paper originally presented before the Civic Club of San Francisco by Colonel H. D. Loveland, entitled "How Commissions Regard Utilities."

In next to the last paragraph of the paper, Colonel Loveland is credited with making certain statements which it does not seem proper should go unchallenged. I refer specifically to the following statement: "A utility which cost \$20,000,000, immediately capitalized for \$80,000,000, with an earning capacity of \$8,000,000 and expenses of approximately \$4,000,000, was compelled to apply to the Commission for permission to issue notes, or equipment certificates, to procure necessary equipment."

Colonel Loveland could only have made such a statement based upon the most inaccurate knowledge of the actual facts.

The United Railroads of San Francisco was organized in 1902. Prior to its organization, the constituent companies had been acquired by Eastern interests by the payment in cash to the original owners of a little over \$26,000,000. The men who made the investment capitalized the company upon the basis of 10 per cent on the cash required to purchase the properties. In other words, they expected and hoped to realize \$2,600,000 per annum from their prior investment of \$26,000,000, and with this end in view, they issued a 4 per cent mortgage on the property in the aggregate sum of \$40,000,000, which sum, based upon their estimates, would be adequate to provide the necessary additional capital for additions and betterments, as well as to retire the underlying mortgages, amounting to approximately \$15,000,000, as they fell due. Of this amount \$20,000,000 was immediately issued and sold. They also issued \$20,000,000 of preferred stock limited to 4 per cent dividends and \$20,000,000 of common stock limited to 5 per cent dividends. The interest on the 4 per cent bonds issued and sold amounted to \$800,000 per annum, dividends on the preferred stock at the rate of 4 per cent would amount to \$800,000 per annum maximum, and the maximum dividends on the common stock at the rate of 5 per cent per annum would amount to \$1,000,000. In other words, the interest on the bonds, plus the dividends on both the preferred and common stock, would amount to \$2,600,000 per annum, or exactly 10 per cent on the cash cost of the property.

How far the expectations of the original organizers came from being realized is illustrated by the fact that instead of receiving \$2,600,000 per annum on their investment, the total amount paid out by the company in the way of interest and dividends on these securities has averaged \$1,108,333 per annum, or $4\frac{1}{4}$ per cent.

The mortgage which was created specifically provided that all earnings in excess of the amount required to pay 5 per cent dividends on the common stock should be used either for additions and betterment, or for additions to the sinking fund provided for retiring the 4 per cent bonds.

Whether such a capitalization was justifiable or not in accordance with present standards is not at issue, but it is unquestionably a fact that at the time the organization of the company was effected in 1902, such methods were in universal practice and were unquestioned.

Reverting to Colonel Loveland's statement quoted above, it can be proven without question that the property originally cost more than \$26,000,000 in cash, and since the date of the organization of the United Railroads of San Francisco there have been for additions and betterments expenditures amounting to approximately \$12,000,000, exclusive of maintenance or renewals. In other words, the actual cash invested in the United Railroads of San Francisco since 1902, and including the amount required for the purchase of the underlying companies, amounts to approximately \$38,000,000 and not \$20,000,000, as stated.

Colonel Loveland proceeds to state as follows:

"Do you think for one moment that that utility, under wise and reasonable regulation, would have found itself in that position?" which means, of course, the application to issue notes or equipment certificates to procure necessary equipment.

Generally speaking, it is universally recognized that any company investing money in additions or betterments to its property is entitled to capitalize such money, and this is all that was asked in the application referred to.

To take care of the increased business which could reasonably be looked forward to, additional rolling stock was required, and the company naturally and legitimately filed an application requesting permission to capitalize such expenditures.

Is there anything in such a proceeding which calls for criticism?

It is no answer to say that the company should have sufficient or ample means on hand obtained from earnings to furnish this cash, and, in fact, the company might be justly criticized if it appropriated money from its earnings for such betterments without capitalizing them.

CHAS. N. BLACK,

San Francisco, Cal.,
July 17, 1914.

Vice-President and General Manager
United Railroads of San Francisco.

Praise of "The Multiple Arch Dam."

To the Editor:—All sorts of copy finds its way into the sanctum of the editor. If the publication be devoted to technical or commercio-technical subjects, the desired copy may be analytical, theoretical, descriptive, or commentary, but in any event it is intended to be instructive and hence, if accurate, is of benefit to some of the readers if not to all. For this reason much of the copy received is used sooner or later. In the rank and file of technical magazines the essence for good is pretty well distilled from most articles by the technical reader, because he reads, not for amusement, but for the knowledge, or the experience of others, which he may acquire, and he automatically discards the rest. A large majority of writings are read once, or perhaps, glanced over, because the import and the knowledge to be gained may be as easily absorbed and retained and whether remembered in

detail or not makes their impression upon the subconscious mind in proportion to its real value as the premises on which to base thought arguments.

But once in awhile, relatively a very great while, there appears a classic which stands out like an evening star which by its superior brilliancy throws an entire firmament into a dim background—an effort of genius which can be read and studied and restudied because it tells of fundamentals.

Such is the monograph on "The Multiple Arched Dam," by Mr. John S. Eastwood in the July 18th, issue of the Journal of Electricity, Power and Gas. While describing his own work he has gone further and has done what few real engineers, i. e. those who think constructively as they work and thereby add something to the world's knowledge and good, have the time or ability to do. He has pointed the way of his line of reasoning in so simple a manner that fundamental methods and the reasons therefor may be understood by anyone who will study it, and accurate results must follow as a matter of course. Of all of the many departments in civil engineering, the construction of dams has been the most baffling. Not that there is anything mysterious in proper dam design, but rather, due to the very magnitude of the restrained forces the desire to cling to the appeal of the imagination rather than a dependence upon thoroughly scientific analysis and synthesis has made dam design in the past, largely a matter of guesswork. This is proven by the dam failures where the structures were designed quite in accordance with the conventional methods and formulae in use by engineers which have been, at the best, meagre and primitive.

Mr. Eastwood tells of a system where there is no element of uncertainty and no guesswork enters into his construction. Precedent, which is often another word for ignorance, does not control any feature of the design, and premises based upon opinion are banished. The methods are highly scientific.

The Journal is to be congratulated on its good fortune in being able to publish such a splendid article, because such efforts are the secret of the high standing which the Journal maintains among the world's technical periodicals.

I hope that every engineering society may give notice to this article and may classify it in its library as one of its big contributions. And I hope that every engineer may not only read, but may study the refined effort of a man who stands foremost in the noble rank of true engineers.

Respectfully yours,

RUDOLPH W. VAN NORDEN.

The cost of gasoline car travel is low according to the figures of three hundred owners of small cars of one make. The period considered covered nine and one-half months and each car was driven an average distance of 5,273 miles and had carried an average load of approximately 444 lb. (three persons) the entire distance. It cost an average of \$55.02 per car for gasoline, the expense for lubricating oil being \$6.28. Repairs, overhauling, etc., cost \$18.19, which gives a total cost of one and one-half cents per mile.

THE THERMO-RELAY.

A New Protective Device.

BY B. B. BECKETT.

The thermo-relay is, as its name implies, a device for controlling electric circuits by means of the heating effect of a current, rather than the volume of current. This is the same as saying that it involves the element of time, since the heat produced is the product of current and time; but it differs in this respect from the ordinary time limit relay or inverse time relay in that it takes account of all that has gone before. Thus if a motor has been running for some time and has already become hot, the thermo-relay will also be hot and its overload time limit will be reduced accordingly. Similarly it takes account of the temperature of the surrounding air, so that less overload is permitted in hot weather than in cold.

A moment's consideration will show the broad application and revolutionary character of this principle. All protective devices in common use at the present time, overload circuit breaker, time limit relay, or simple fuse, are intended to protect by limiting the current, whereas, the danger is really from heat. Practically, the capacity of all electrical apparatus is limited by its heating; why not, therefore, limit the temperature rather than the current? Of course, this is the same thing under constant operating conditions, since the current produces the heat, but it is

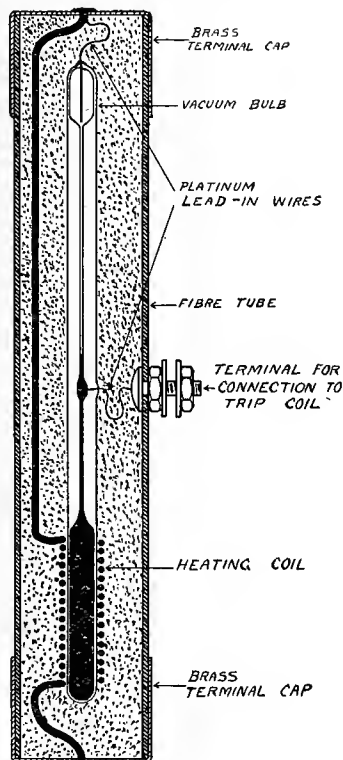


Fig. 1. Section Through One Form of Thermo-Relay.

not the same thing when the conditions are not constant, as they generally are not in practice. For instance, in carrying a fluctuating load, it is not the value of the current at any instant nor its average value, nor even its r.m.s. value, unless the computation be made over a proper period of time, and no apparatus has so far been developed that will make such

a computation. Thus a railway or elevator motor has no protection whatever against over-heating, since the circuit breaker or other protective device must be set high enough to permit overloads that would destroy the motor if continued long enough. In fact, the same

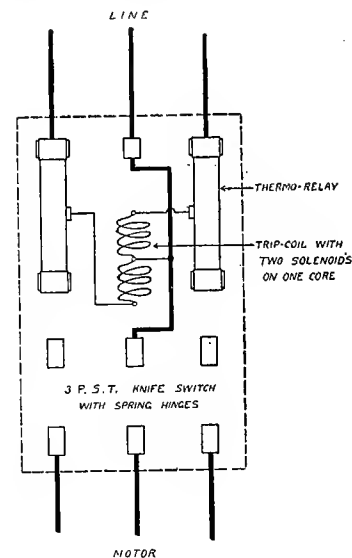


Fig. 2. Thermo-Relay Connections for Small Three-Phase Motor.

is true even with motors operating under steady loads, such for instance, as a centrifugal pump; for it is common practice to install fuses of considerably larger capacity than the normal rated current, else a drop in line voltage or fluctuation of frequency of too short duration to harm the motor, will nevertheless cause the fuses to blow, with resulting expense and annoyance.

The time limit relay was developed to meet just this condition, but the time limit relay, as previously pointed out, has the same time limit characteristics, whether the motor is hot or cold and whether the air temperature is high or low. What is wanted, in order to permit full advantage to be taken of the inherent overload capacity of the motor, is a relay that will follow the heating of the motor and will act when and only when the motor becomes dangerously hot. This is what the thermo-relay does, with the added advantage of simplicity, low cost and "fool-proofness," as compared with the time limit relay.

The thermo-relay is particularly applicable to cases where a polyphase motor is liable to be left connected to one phase, due to a broken line wire or a blown fuse. This is perhaps the most fruitful cause of burn-outs in small motors. Large motors may be protected by carefully adjusted time limit relays, but for small motors, this apparatus is generally too expensive and too complicated. Most small motors, as previously stated, are necessarily "over-fused" and when left to run on one phase, will burn out without blowing their fuses. Even if the fuses do blow, the resulting expense and annoyance is considerable on lines where troubles are frequent.

Again, for motors in intermittent service with automatic control, there is no adequate protection at the present time. Take for instance, a railway air compressor. The protecting fuse must be large enough

to permit the starting current, one-fifth of which will generally burn the motor out if continued long enough. This does not happen often in railway practice simply because the compressor is used on a fairly definite schedule for which the motor is designed, but in industrial compressors and in small water pumping systems, either with open or closed tank control, burn-outs from this cause are becoming increasingly common. Most motors in this service are small and are controlled by a simple switch operated directly by air pressure acting upon a piston or diaphragm and protected only by fuses which must be large enough to permit the starting current of five to ten times normal. Then if one fuse should blow or if one line wire is down, the motor will be closed on one phase and the resulting current will not be large

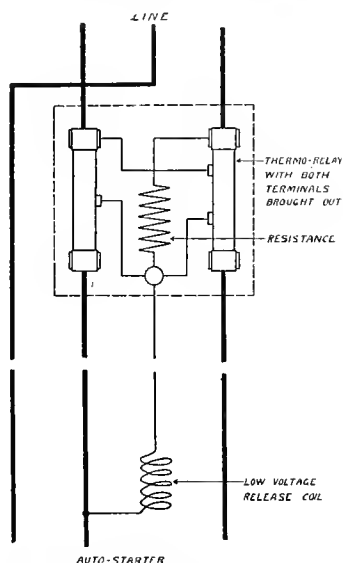


Fig. 3. Thermo-Relay Used With Auto Starter Having Low Voltage Release Coil.

enough to blow the other two fuses, since it will be equal to the normal starting current times $\frac{1}{2}\sqrt{3}$. This is of fairly common occurrence and the motor inevitably burns out, sometimes setting fire to the building in which it is installed. Even if a time limit relay is used, unless it is set very close, the motor may be already hot and may burn out within the time limit of the relay.

Many other applications at once suggest themselves. For instance, pole transformers on city lighting systems are generally protected only by fuses which must correspond to the continuous, hot weather, safe current, without overload, else the protection is incomplete. Transformers have a large overload capacity for a short time, and further can safely carry a greater load in winter than in summer, a desirable feature, since lighting loads are heaviest in winter. The advantage of the thermo-relay in permitting a more economical loading of transformers with entire safety is evident.

One form of thermo-relay is illustrated in the accompanying diagram. It consists essentially of a contact-making thermometer having its bulb surrounded by a heating element in series with the line wire and the whole covered with heat insulating material. The thermo-relay operates the trip coil of an automatic switch through an auxiliary circuit like any relay.

The temperature time characteristic may be varied to any desired extent by simply varying the degree of heat insulation. If the heating element is left bare and has a large surface exposed to radiation, it will reach a constant temperature quickly and vice-versa.

A simple design for small motors consists of a thermometer about four inches long encased in a fibre cartridge like an ordinary cartridge fuse, but instead of the fuse, copper wire of about the same size as that in the motor is wound, non inductively, around the thermometer bulb. The cartridge is then filled with asbestos and magnesia powder which serves as a heat insulator and also protects the thermometer against breakage from shock. To prevent breakage by over-expansion of the mercury, a second bulb or reservoir is provided on top of the thermometer stem.

This arrangement is so simple that it may not at first receive the respect it deserves. A severe series of tests has shown that it will not only protect a motor against all possible conditions of loading, but also that it is permanent in characteristic and not easily damaged.

For example, a pair of such thermo-relays, designed for a 1 h.p., 3-phase, 220-volt motor was subjected to about 80 amp. d.c. at 500 volts and finally to 2200 volts a.c. without damage of any sort. These relays were mounted upon a slate base with a simple trip switch to which they were connected in the manner shown in the accompanying diagram. The motor which they protect is connected to a pump running intermittently with "closed tank" automatic control, and before the installation of the relays was several times burned out by being left on single phase. This motor has since been connected single phase, both while running and while stopped, when hot and when cold, when lightly loaded and when overloaded, without damage of any sort. In each case, the switch tripped out before a dangerous temperature was reached.

The same form of thermo-relay may be used in connection with auto-starters having low voltage release coils.

For this purpose, the relays are mounted upon a separate block with a resistance which is connected in series with the low-voltage release coil as shown in the accompanying diagram. The relays then short circuit the release coil, leaving the resistance, which may be a lamp, left directly across the line. Many other arrangements are possible. The mercury thermometer is not essential and solid metallic elements may be found better in some cases. The essential feature is that the device responds to heat with a predetermined temperature time characteristic. It differs from a thermostat, which seeks to maintain a constant temperature in the surrounding medium. The thermo-relay seeks to limit the temperature in a distant apparatus by storing up heat in itself at the same rate.

X-rays are displacing radium for many therapeutic purposes in Europe, particularly in the treatment of cancer. Recent improvements in the design of Roentgen tubes give a greater proportion of "hard" rays which are most penetrating and consequently do not destroy the sound tissues overlaying the diseased part.

PUBLIC POLICY OF PUBLIC UTILITY CORPORATIONS

THE TELEPHONE PROBLEM.

BY. D. P. FULLERTON.

[Concluded.]

Six years ago we had 264,000 stations connected with our system, while today we have 648,000, or an increase of 145 per cent. In other words, for every 1 per cent increase in population there has been a four per cent increase in subscribers' stations. This will give you some idea of the magnitude of the task imposed upon this company of developing an organization competent to meet this phenomenal growth and concomitant demand for telephone service.

Rates and Service.

The provisions of adequate facilities mean, of course, the study of adequate rates; that is, rates that are not only fair to the company and to the public, but rates that will in every way tend to improve the service and satisfy the customer. A complexity of the rate problem is one whose magnitude is probably not realized by the average person. We have in our territory over 600 exchanges and approximately 4000 toll rate points. This necessitates the determination and quotation of approximately 16,000,000 rates.

Following the determination of what the rates for telephone service shall be and their acceptance by the state or municipal bodies empowered to authorize their application comes the sale of service.

Having determined the rates and sold the service, we must collect our charges for the service rendered. This function involves the monthly collection of approximately 405,000 accounts, averaging about \$4.35 per account. There is probably no function we perform which brings us in as close personal contact with our patrons as the collections of the revenue. When you touch a man's pocketbook you touch his temper, which means that public relations and collections cannot be disassociated.

This brings us down to public relations and public relations depend entirely upon the rates and service, and in discussing this question I will make free to quote later on from a decision rendered November 11, 1913, by the railroad commission of the state of Michigan after an investigation as to the character of the telephone service in the city of Detroit, which decision, I believe, sets forth very plainly the fact that the abuse of the telephone by the subscriber and his utter disregard of the stipulations of the contract that he has made with the company is in the main responsible for the poor quality of the service of which he has complained.

Before quoting the decision, I want to say that when a sufficiency of facilities and operating force has been provided to give the maximum of service, which the public under their contracts may reasonably demand, and I wish to emphasize this last sentence because it does not follow that the service is necessarily of the quality that the patrons may desire. I am persuaded that the complaints which are made have their basis in the unsatisfactory conditions that are a part of and incident to the service sold by the company. The general public does not recognize a variety in the quality of the service furnished by a telephone com-

pany as permissible. The general tendency is to insist that all telephone service should be of one quality, and that a high quality, irrespective of the price paid for it or the conditions under which it is furnished. Yet the limitations placed upon telephone service to provide for a lessened rate than that required for unlimited service, from the very nature of things, are limitations upon both quality and quantity. It would hardly seem necessary to state that four individuals, patrons on one line, by the very limitations of the facilities employed, can not receive the amount of service they could receive on individual lines, while inability to segregate the time when each party on a party line may receive his portion of service markedly lessens the quality of that service. Axiomatic as this statement may be, it is one that is practically controverted by many telephone users. The general public are not made satisfied with poor service by being furnished it at a low rate.

The Detroit Situation.

To quote from the Detroit Decision, the percentage of party line telephones in the Detroit Exchange of the Michigan State Telephone Company is 52 per cent of its total telephones in service:

The traffic incident to this class of service is as might be expected. Throughout the Detroit system there is a daily average of 9.5 calls per telephone. This is a calling rate from 25 to 50 per cent higher than found in nearly every other large city in the country. The high saturation of party line telephones upon flat rate results in an excessive daily call average and, in our opinion, forms the basis for the major portion of complaint against the Detroit service.

Competent engineers have given it as their conviction and experience that 60 per cent of all routine trouble in a telephone system is due to party line conditions, such as ring overs and line interference. This is an important factor to be borne in mind.

The present contract between the company and its subscribers contains the following clause:

Limited Service.

(For residence only.)

Company may cancel contract if subscriber exceeds four calls per day, including outgoing and incoming. No call shall exceed five minutes in duration.

There are in the Detroit system 35,755 party line telephones to which, under the terms of the contract under which the telephones were installed, the foregoing limitation applies. If therefore, every telephone of this class received the full limit of service to which it was entitled, it would entail a total of 143,020 calls. An effort was made to ascertain the percentage of calls that were justly apportionable to party lines.

It was the claim of the company that 65 per cent of all calls either originated or terminated upon party lines. The company compiled figures from the incoming calls for one day and demonstrated that 42 per cent of all incoming calls were from party lines. For the purpose of verifying this claim, a large number of tests were made by representatives of the commission upon incoming trunk positions and 45 per cent of the incoming calls were found to be from party lines. So that 42 per cent may be safely taken as the average for the entire system. There were, at

the time of the inspection, 765,000 calls per day through the system. Forty-two per cent of this would be 321,300 calls or 178,280 calls in excess of what the particular telephone patrons are entitled to under their contracts. This is more than 23 per cent of all the traffic that passes through the Detroit exchange. If the outgoing calls are sufficient to raise the total calls chargeable to party lines to 65 per cent of the total, as claimed by the company, the burden is still more apparent. A large number of two and four party residence telephones were supervised for a period of one week. Out of this number, as examples, fifteen telephones on two-party residence lines showed an average of thirty calls each per day and a like number on four-party residence lines showed an average of twenty-one calls each per day instead of four calls that each were entitled to under the rules of the company and its contracts with its patrons.

All telephone conversations, by good practice and by contract, are limited to a duration of five minutes. The record shows that out of 6000 conversations supervised, 13 per cent exceeded the five-minute limitation. This, applied to the entire system, was 99,450 daily conversations that exceeded the five minute limit. That this entails a burden of repeated calls and busy tests to the annoyance, not to say exasperation, of other patrons, is readily imagined.

There is likewise an abuse of the unlimited highest price service furnished by the company. Every telephone installed, party line or otherwise, is upon the express stipulation that "the service is for the exclusive use of the lessee, his employees and the members of his family." If this provision was even reasonably observed it would lessen the average daily calls through the entire system by more than 50,000 calls daily. There are hundreds of telephones installed, especially in the downtown district, in cigar stores, saloons, cafes and other places, that are installed by the proprietors as business attractions. They are purposely placed where they are convenient to the public which is invited to a free and indiscriminate use of the facility. A six days' supervision was made upon certain lines serving telephones of this character, and as examples, fifteen telephones were selected that showed an average daily calling rate for the fifteen of 1694 calls and 1184 completed conversations. It is a conservative statement to say that more than 90 per cent of this traffic was by persons other than the lessee of the telephone, his family and employees. It was furnished without cost to those who received it and it is a matter of common knowledge that a large percentage of the conversations were of small moment to the parties participating and that they never would have taken place if even the smallest charge had been required. It is interesting, in this connection, to know that between eight and nine thousand calls daily are made in the Detroit system, the only purpose of which is to inquire the time of day. These things tend to congest traffic, especially upon the party lines. They lower the quality of service and invite a train of complaints that are as varied as human irritability.

This decision, I feel, must convince you that while public relations necessarily depend entirely upon the rates and service provided by the company, the public must, as before stated, be educated to the proper

uses of the telephone to the observance of his contractual relations with the company and to the unalterable fact that low rates and good service have no relation one with another.

Misuse of the Telephone.

The reference made in the decision to the calls for the time of day is an excellent illustration of the misuse of a telephone. It may be interesting to know that our experience in this has developed that in one day in San Francisco we have had 15,997 calls of the same kind and that in Chicago, an exchange of 350,000 stations, in one day the time of day was given to subscribers 105,630 times, or about one call for the time of day from each three stations.

You, of course, will agree with me that when service was contracted for none of these subscribers had in mind making any such use of the telephone. Business telephones were contracted for as an adjunct of the business of the subscriber, and residence or personal telephones were contracted for for convenient communications and protection. The use of a business telephone for purposes other than the business with which it is associated and the frivolous use of a residence telephone our records show are largely responsible for the delinquencies in service that are charged up against the telephone company.

Probably some of those present have been annoyed by the joker and near-humorist who asks your office boy to have you call a given telephone number and ask for "Mr. C. Lyon" and when you get the call you discover that you are calling the Cliff House. Others of these jokers call the morgue and ask for "Mr. Stiff," or the ball grounds and ask for "Mr. Batt," or for the Oakland Mole and ask for "Mr. Ferry."

This misuse of a telephone is one that the average subscriber probably does not consider as seriously interfering with his service or the service of his neighbor, and it would probably surprise you to know that the victim of the joker frequently complains to the telephone company that such use is made of his lines and seems to think that the responsibility of preventing such practices rests upon the shoulders of the utility.

Another serious problem which telephone engineers are endeavoring to control is the part played by the subscriber in the matter of transmission. Investigation has developed that a large majority of telephone users when using the telephone talk in every direction except that towards the transmitter, and that on top of this they do not seem to realize that it is the job of the telephone engineer to develop apparatus that will provide the very best transmission and the best of all other forms of service, for, as you know, a telephone company has nothing whatever to sell except service, but will lend themselves to every catch-penny device that comes along and load up the telephone supplied for their use with all sorts of appliances which the seller will guarantee to perform all sorts of miracles, and which the telephone engineer will guarantee will not only not do any of these things but will seriously affect the transmitting qualities of the telephone.

Our records show a long list of amusing and ridiculous uses to which telephones have been put, the latest being that of an Oakland man, who used it

as a deadly weapon while disciplining his wife. Our records fail to show in this particular case whether such was detrimental to the service or not, but we assume that its use was detrimental to his better half.

Another phase in the education of the public in the use of the telephone is the difficulty in convincing the subscriber that the special stunts he wants his telephone to perform are not only detrimental to his service but likewise detrimental to the service of his fellow subscribers.

Like all other public utilities, the telephone company is anxious that its relations with the public shall be of the highest order, but the very fact that it produces an efficient plant and turns this plant over to the untrained but exacting public to use and abuse and be compelled unjustly and uncomplainingly to assume all of the responsibility for the various delinquencies in the service, certainly proves that all of the tact, all of the diplomacy and all of the ingenuity of its engineers must be worked overtime in an endeavor to master the greatest of all telephone problems—that of teaching the public the proper use of the telephone.

A. I. E. E. STANDARDIZATION RULES.

At a meeting of the Board of Directors of the American Institute of Electrical Engineers held at the Detroit Convention on June 25th, the report of the Standards Committee submitting to the Board the Standardization Rules as recommended for adoption by that committee was presented, but consideration was postponed to an adjourned meeting to be held in New York on Friday, July 10th, and an invitation was extended to the members of the Standards Committee and representatives of other societies who had collaborated in the work of the committee to attend this meeting for the purpose of a thorough discussion of the matter.

The meeting was held on July 10th, and was attended by members of the Board the Standards Committee, and others interested. After a comprehensive discussion the following resolution was unanimously adopted:

"Resolved, That the rules reported by the Standards Committee be, and hereby are, adopted, to take effect on December 1, 1914, subject to editorial revision by the committee for the purpose of correcting errors and clarifying the real intent of the rules."

Later the Board convened in executive session and adopted the resolution as recommended. The Board also directed that the proposed rules be printed in the August issue of the Institute Proceedings.

Resolutions were then adopted by the Board of Directors expressing appreciation of the services rendered to the Institute by Dr. A. E. Kennelly, chairman; Professor C. A. Adams, secretary, and the other members of the Standards Committee, and its various sub-committees, in performing the arduous duty of revising the rules.

The National Electric Light Association and the Association of Edison Illuminating Companies were also thanked for their co-operation with the Standards Committee in connection with this work.

GATE STRUCTURES FOR IRRIGATION CANALS.

Most of the gate structures in American irrigation canals a few years ago were of wood, but more recently concrete, both plain and reinforced, has come into common use. Wood has the advantage of cheapness and of easy handling, and the disadvantage of rapid depreciation, while concrete, which has the advantage of permanence, is more costly. The kind of material used, as well as other features of gate structures, varies in different irrigated regions of the West. One section often uses features especially adapted to it, of which other sections, that could use them equally well, are ignorant. The U. S. Department of Agriculture is endeavoring to bring together such designs for gate structures as are adapted to many localities, so that each locality may profit by the practices of others, and has just issued a new bulletin (No. 115), entitled "Gate Structures for Irrigation Canals," intended to be of assistance to engineers and others with technical knowledge of the subject.

The new bulletin contains 61 pages and numerous plates and figures illustrating structures that have already proved practicable. The new bulletin is strictly a professional paper, and of little interest to the farmer in general, but the attention of engineers and directors of farmers' canal companies in the irrigated sections of the West is invited to its contents. The bulletin may be had free as long as the department's supply lasts.

Small and medium-sized structures are for the most part described in the new bulletin, as it is believed that most of the problems confronting the engineer located in isolated regions of the West relate to this class. The bulletin should also be of value to directors of mutual water companies who are themselves irrigators, and who are called upon to pass upon questions of construction and maintenance.

Continuous sustained sounds similar to those on the organ have been produced by a French engineer named Bevierre, from stringed instruments such as the piano and violin, by the use of an electro magnetic process. It is thought that the invention will have an important influence not only upon execution, but upon composition. It is the inventor's belief that the piano hammers will become obsolete and the violin bow eventually unknown.

A system of supplementary transportation is, it is stated, about to be adopted by the Canadian Pacific Railway Company which will practically bring the railway to the barn door of every farmer in its territory. Every station will be made the depot for a fleet of motor wagons of a type especially designed for this service, the number varying with the size and importance of the district served. It is expected that important stations will have from 12 to 20 of these auxiliaries in service. Owing to the nature of the country served the trucks will not have to negotiate heavy grades and they are to be designed to carry a load of about one-sixth that of a freight car being particularly adapted for carrying grain.

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Regulation of public utilities is much more like regulation of mechanical movements than is generally imagined. The function of each is accomplished by establishing a balance or equilibrium between counteracting forces.

Regulation

The pendulum of progress is actuated by the driving force of private initiative, which in turn is counteracted by the damping force of public opinion; one is centrifugal, the other is centripetal.

Public opinion is as irresistible as gravity and as extensive as the earth's magnetic field. While the opinion of one individual is proportionately as powerless as the weight of a drop of water the aggregate opinion of many individuals carries the mighty power of the water-fall. Yet like the action of gravitation on a falling body or of magnetism on a compass needle its tendency is to bring all to the same level. It is essentially a negative or static force.

Private initiative is positive, dynamic. As the active expression of ability and ambition it is responsible for the world's advance. It is the main spring of the clock whose dial records the progression of the ages.

Some sort of a balance or equilibrium must be established between these opposing forces, one ever forcing profits up, the other ever forcing profits down. Several methods of harmonizing the conflicting interests of the public and the investor have been tried.

For a long time it was thought that competition could automatically perform these regulating functions. But it was found that where competition was blind, it killed private initiative, and where it was clear sighted, consolidation defeated the public interest.

Direct regulation by legislative bodies has also been tried and found wanting. Lawmaking bodies are slow and unwieldy; to be effective, regulation must be quick and delicate.

Public ownership is another alternative for the regulation of profits in the supply of utilities. In communities where the people are willing to have the taxpayer bear the burden of political operation, this experiment gives some promise of success. Some wise men see the ultimate solution of the utility problem in public ownership and private operation, coupling rather than opposing these two fundamental forces, rewarding the efficiency of individual initiative and increasing the public profit.

But the most satisfactory regulator for the seesaw of rates yet proposed is the public service commission.

The public service commission is the lever or index which alters the effective length of the hair-spring, it is the screw which shortens or lengthens the pendulum; it is the balance valve which controls the admission of the steam overcoming the inertia of the engine and its load; it is the regulator which maintains constant voltage under varying load; it is

the legalized vigilance committee in the financial community.

Efficient public service commissions have been established in nearly every state of the Union, the commissioners are men of high character and great determination, (though lacking in knowledge of engineering, the basis of every public service), the companies are cleaning house, even to the extent that the sins of the directors are being visited upon the stockholders unto the third and fourth generation, and the public should do their part in fairly and patiently waiting the outcome of this brave attempt to establish harmony.

Frank A. Vanderlip, president of the National City Bank of New York City, recently said, "The inefficiency of the farming industry is the most serious of our present perplexities." More efficient farm methods will do more

to reduce the high cost of living and counteract the law of diminishing returns than any other one factor. The use of land in raising produce is just as much a public service as is the use of land in transporting the products, and in England it is so regulated. Farming has been called our most important public utility, the farmer holding the land as a trust placed in his care by the Creator.

The farmer needs means of cheaper production, getting more for less effort. The engineer, as the man who has overcome all other natural obstacles, will here find a virgin field well worth his attention. It is the engineer who has introduced efficient methods into all other industries and it is to the engineer that the farmer must now look for aid.

The most promising agent wherewith this may be accomplished is electricity. So far it has done little on the farm besides replacing wind-power for pumping water and manual power for many of the farm chores. Most of the heavier work is still done by the horse.

In many localities, this has perhaps been due to the fact that electricity was not available. Now that there is hardly a farm which is not within reach of central station distribution lines this excuse no longer exists. In these Western states particularly, where there is such abundance of cheap hydroelectric energy, the cost of electric power is less than half that of horsepower. The difficulty lies not in the power, but in its application.

There is no device on the American market today which can take the place of a team of horses for the work on a 75 acre farm, which government statistics show to be the average area cultivated by a single American farmer. Notwithstanding such drawbacks as low fuel efficiency, high maintenance costs, limited overload capacity and rapid depreciation, the horse still holds his own because his operation and control is mechanically simple and because he is reliable even under abuse and neglect.

Steam tractors are not satisfactory in small units

because of their great weight and because a skilled operator is necessary.

Gasoline tractors, while more economical in fuel consumption, have a high upkeep because of the severe service in adapting a constant speed uni-directional motion to the great load variation and direction changes required in plowing. Clutches and gears are readily broken and small units have not proven satisfactory. For farms of from 200 to 600 acres this form of tractor is meeting success, for large acreages the steam tractor is sufficient, but for the small farm there is great need of an electric tractor.

Each acre requires at least 25 horse power hours for its cultivation each year. When it is considered that twenty million horses and mules are required to furnish the twelve and one-half billion horse-power hours thus necessary to plow and harrow our five-hundred million acres of cultivated land, the great opportunity for mechanical power is apparent. The vast acreage now devoted to forage and which would be released to raise food for human consumption is appalling.

The mechanical difficulties in the construction of a suitable tractor are many. In plowing, the load fluctuates from almost nothing when dragging the plow to an overload of six or eight hundred per cent when a root or rock is struck. A momentary overload of from 100 to 500 per cent above normal occurs when the plow enters the ground. A two horse team usually develops an even draw-bar pull of 250 lb. when moving two miles an hour. The work must be cleanly done, the tractor should move backward or forward with equal ease and should be easily and quickly turned, especially in orchard work. Furthermore it should not make the ground too compact and above all else it must be fool-proof.

Low first cost must be the first essential of such a tractor; \$750 being perhaps a maximum for a machine with a life of twenty years, replacing a team with a life of fifteen years. The cost of operation should be less than \$2.00 an acre, which is an average figure for horse plowing. It should have a radius of operation of at least a quarter of a mile, be easily and accurately controlled, readily repaired, simple and rugged in design.

Such specifications are not insurmountable for engineering talent. Satisfactory motor control is now available, and the experience gained in dredge and automobile construction has blazed the trail, much as the gasoline automobile paved the way for the aeroplane.

Aside from the great opportunity for the manufacturer in marketing such a device, it should also appeal to the central station man as a desirable load. The expense for experimentation would be high and might well be borne by some joint association of manufacturers and central stations, such as the Society for Electrical Development. The results would not only develop a new and large use for electric power and apparatus, but would represent true conservation in its finest sense.

PERSONALS

W. J. Norton, rate expert from Chicago, spent the past week at San Francisco and is now at Los Angeles.

John B. Miller, president of the Southern California Edison Company, recently returned to Los Angeles from Europe.

C. H. Johnson, representative of C. A. Wood Preserver Company, San Francisco is on a business trip through Central California.

H. R. Noack, president of Pierson, Roeding & Co., San Francisco, has returned from an extended trip through Plumas County.

J. J. Estabrook, Pacific Coast Representative of the Standard Time Company was at Seattle from San Francisco during the past week.

W. A. Dunbar, salesman with Westinghouse Electric and Manufacturing Company, San Francisco, spent the past week in Southern California.

H. A. Russell, manager sales department of General Electric Company at San Francisco, has returned from an extended trip through Oregon.

A. E. Wishon, assistant general manager of the San Joaquin Light and Power Corporation at Fresno, was a visitor to San Francisco during the week.

W. F. Neiman, city sales manager of the Great Western Power Company, San Francisco, returned recently from a several weeks' trip through the North of Bay Counties region.

Hazard Stevens, president of the Olympia Light & Power Company of Olympia, Washington, was recently at Seattle investigating a new process for producing by-products from stumps.

George C. Sawyer of the Pacific Power & Light Company at North Yakima, Washington, has been appointed Jovian Statesman for North Yakima and vicinity, C. A. Norton having resigned.

W. C. Wurfell, district manager of the Westinghouse Lamp Company with headquarters at Salt Lake City has been spending the past week with his family at Vivian Park Forks, Provo Canyon.

W. H. Hanbridge, secretary of the California State Electrical Contractors' Association, San Francisco, is visiting Los Angeles and Southern California on business connected with the association.

R. E. Jerauld, representative of the General Electric Company at Boise, Idaho, was called into the Salt Lake office last week in connection with certain propositions under consideration in his territory.

L. P. Van Alta and **W. M. Werner** of the Pacific States Electric Company, San Francisco, are receiving the congratulations of their friends and co-workers, having recently joined the ranks of benedicts.

H. L. Rase, sales representative of the Pacific Coast Specialties Company of Oakland, Cal., Pacific Coast distributors of the Frantz Premier Electric Suction Cleaners, called on Seattle, Wash., dealers last week.

John C. Rendler, electrical contractor at Los Angeles, was elected vice-president of the Mutual Electrical Contractors' Association at Detroit. The 1915 convention of the association will be held at San Francisco.

L. Wood Davis, district representative of the Westinghouse Lamp Company for the states of Montana and Washington with headquarters at Butte is spending his two weeks vacation in Salt Lake City visiting with his mother.

J. C. Stevens having recently completed his work as chief engineer in the installation of two hydroelectric power plants for the Pearson Engineering Company, near Barcelona, Spain, has opened an engineering office in the Spalding Building, at Portland, Ore.

H. W. Dyson, formerly assistant comptroller for the B. S. Electric Railway Company has been promoted to comptroller in place of **George Kidd**, now general manager. Mr. Dyson has just returned to Vancouver, B. C., from a visit of nearly four months to England.

R. J. Monroe has been appointed district representative of the General Motors Truck Company with headquarters at Denver succeeding **Dr. Melcher Ekstromer**, who has been transferred to St. Louis. Mr. Monroe spent a few days in Salt Lake City this week on a trip of inspection over his territory.

W. V. Hunt, for the past twelve years, connected with the company and latterly as electrical engineer of the B. C. Electric Railway Company at Vancouver, B. C., has resigned from that position, the resignation being accepted by the management. Mr. Hunt will engage in the electrical garage business at Vancouver.

G. R. Grieve has been appointed chief correspondent for the local office of the Westinghouse Electric & Manufacturing Company at Salt Lake City, succeeding **Harry B. Dresser**, who was transferred to the Westinghouse Lamp Company. Mr. Grieve was formerly treasurer of the Leyner Drill & Compressor Company of Denver, Colo.

Ralph Modjeski, consulting engineer of Portland, Ore., who is now at Los Angeles, Cal., has been selected by the directors of the Burrard Inlet Tunnel & Bridge Company to adjudicate upon the three designs and bids submitted for the construction of the bridge across Burrard Inlet at Second Narrows near Vancouver B. C. It is stated that his fee will be \$3000.

Morton McCartney, city engineer for Spokane, Wash., has prepared plans for an electrolier street lighting system on First avenue. The estimated average cost is \$80 per annum for each of the 88 posts over a period of 10 years. Under the proposed plan, the conduit, wiring and other equipment will become the property of the city at the termination of that time.

G. Jensen, of the engineering staff of the Canadian Northern Railway left Vancouver during the latter part of last week for Hope, B. C., whence he will proceed to a point 17 miles distant on the Skagit River where the company proposes establishing an electric power plant. Power from this development will, it is stated, be used for electric traction purposes on this company's system.

F. H. Welling, local manager of the Federal Sign System, Electric, with headquarters at San Francisco, stopped over in Salt Lake last week on his way to the company's home office in Chicago. While at Salt Lake, Mr. Welling prepared estimates and submitted prices on the large roof sign, the contract for which was to be let by the Oregon Short Line Railroad Company.

W. A. Moser, with the Westinghouse Manufacturing Company, has returned to Salt Lake City from a 60 days' visit to the company's factory at Pittsburg, where he had gone to familiarize himself with the new "Type H. L." controllers for interurban street cars. Equipment utilizing this new type control has recently been installed for the Utah Light & Railway Company, the Emigration Canyon Railroad Company, the Salt Lake & Ogden R. R. Company, the Ogden, Logan & Preston R. R. Company and the Caldwell Traction Company. The local office found it necessary therefore, to have a representative thoroughly familiar with installation and operation of this apparatus and Mr. Moser was sent back to the factory for this purpose.

James M. Barry, who was recently appointed chief of the department of electricity at San Francisco, is one of the most successful young electrical engineers of the West. Graduating with honor from the electrical engineering department of the University of California in 1910, he served for two years as assistant engineer of underground electrical distribution for the Pacific Gas & Electric Company, at Sacramento, Cal., resigning to become electrical engineer for the city of Sacramento, where he planned and supervised the installation of the underground fire alarm and police signal system. In January, 1913, he was made electrical engineer for the Northwestern Electric Company at Portland, Oregon, where he had charge of the design of the electrical features of the Albina and Pittock stations as well as the underground transmission and distribution systems. In June of this year he accepted his present position for which his training and experience have admirably fitted him and where his host of friends wish him continued success.



W. W. Briggs, general agent for the Great Western Power Company, has been appointed chairman of the San Francisco reception committee of the International Electrical Congress, September 13 to 18, 1915. The other members of the local committee which he has appointed are: **C. F. Conn**, vice-chairman, engineer, J. G. White Company, Alaska Commercial Building; **John A. Britton**, vice-president and general manager Pacific Gas and Electric Company, 445 Sutter street; **H. R. Jackson**, general manager, Sierra and San Francisco Power Company, Holbrook Building; **F. H. Varney**, engineer of steam operation, Pacific Gas and Electric Company, 445 Sutter street; **P. M. Downing**, engineer of hydroelectric operation, Pacific Gas and Electric Company, 445 Sutter street; **W. G. B. Euler**, superintendent of operation, Great Western Power Company, 233 Post street; **E. W. Beardsley**, general superintendent, Great Western Power Company, 233 Post street; **Leo N. Van der Naillen**, general manager, Oco Electric Corporation, Sharon Building; **A. H. Babcock**, electrical engineer, Southern Pacific Company, Flood Building; **S. L. Naphtaly**, vice-president Oakland, Antioch and Eastern Railway Company, 105 Montgomery street; **A. W. McLimont**, general manager, San Francisco-Oakland Terminal Railways, Syndicate Building, Oakland; **C. N. Black**, vice-president and general manager, United Railways, Holbrook Building; **C. E. Heise**, district manager Westinghouse Electric and Manufacturing Company, 165 Second street; **T. E. Bibbins**, local manager, General Electric Company, Rialto Building; **F. W. Webster**, district manager, Allis-Chalmers Company, Rialto Building; **Colonel H. D. Loveland**, Railroad Commissioner, State of California, 833 Market street; **A. H. Halloran**, managing editor Journal of Electricity, Power and Gas, Crossley Building; **T. E. Ransom**, consulting engineer, Board of Public Works; **C. L. Cory**, University of California, Berkeley; **H. J. Ryan**, Stanford University; **F. G. Baum**, consulting engineer, Chronicle Building; **A. H. Griswold**, engineer, The Pacific Telephone and Telegraph Company, 333 Grant avenue, and **Guy C. Bayley**, electrical engineer, Panama-Pacific International Exposition, Service Building, P. P. I. E.

MEETING NOTICES.

Engineers' Club of San Francisco.

About fifty members of the Engineers' Club assembled at lunch on July 21 to hear **Guy Bayley**, electrical and mechanical engineer for the Panama-Pacific International Exposition, speak on the engineering features of the exposition. On Au-

gust 5th, **John A. Britton**, vice-president and general manager of the Pacific Gas & Electric Company, will speak on the proposed 8 hour law in California.

Illuminating Engineering Society.

A. G. Summerell of the National Carbon Company, chairman of the hotel committee for the Eighth Annual Convention of the I. E. S., to be held at Cleveland, September 21st to 25th inclusive, announces that the Hollenden Hotel will be the headquarters. Most if not all of the convention's business sessions will take place in the hotel and the annual reception, ball and banquet will probably be held there as well.

N. E. L. A. General Convention Committee.

John A. Britton, chairman of the general convention committee for the 1915 meeting of the National Electric Light Association at San Francisco, entertained a number of San Francisco electrical men at luncheon at the Hotel St. Francis on July 20th, and announced the appointment of the following sub-committees; the first named being chairman in each case, with power to enlarge his committee as needs require.

Entertainment.

W. W. Briggs
S. V. Walton

Hotel and Local Transport.

F. H. Varney
Wm. Goodwin

Local Registration.

W. F. Neiman
C. J. Wilson

Information Bureau.

R. M. Alvord
Tom Collins

Finance.

G. C. Holberton
Carl Heise

Ladies' Auxiliary.

T. E. Bibbins
J. G. De Remer

Meetings.

S. J. Lisberger
R. J. Cantrell

Press.

A. H. Halloran
F. S. Myrtle

Those who attended the luncheon were:

Pacific Gas & Electric Co.

John A. Britton
D. H. Foote
J. D. Kuster
W. G. Vincent, Jr.
L. H. Newbert
E. C. Jones
F. G. Baum
W. S. Coleman
S. J. Lisberger
P. M. Downing
G. C. Holberton
E. B. Price
S. V. Walton
F. S. Myrtle
A. F. Hockenbeamer
Geo. Bragg
Henry Bostwick

Journal of Electricity.

A. H. Halloran
J. W. Redpath
E. B. Strong

United Light & Power Co.

J. G. De Remer

Great Western Power Co.

W. W. Briggs
W. F. Neiman

Pacific Electric Co.

Wm. Goodwin

Panama-Pacific International Exposition Co.

Guy Bayley

Piersoo-Roeding Co.

Geo. Murphy

General Electric Co.

R. M. Alvord
T. E. Bibbins
Harry Russell
Dr. Thomas Addison
Allen Jones

Northern California Power Co.

Edw. Whaley

Westinghouse Electric & Mfg. Co.

Tom Collins

Pacific Claim Agents' Association.

The newly-elected officers of the Pacific Claim Agents' Association following the convention reported in our last issue, are as follows: **A. M. Lee**, assistant general claim agent, Northern Pacific Railway Company, Seattle, Wash., president; **Thos. G. Ashton**, claim agent, Washington Water Power Company, Spokane, Wash., vice-president; **H. K. Reif**, general claim agent, Spokane, Portland & Seattle Railway, Portland, Ore., second vice-president; **S. A. Bishop**, general claim agent, Pacific Electric Railway Company, Los Angeles, Cal., third vice-president; and **T. N. Henry**, Seattle, Wash., was re-elected secretary-treasurer. The additional six members of the executive committee are as follows: **H. G. Winsor**, general claim agent, Tacoma Railway & Power Company, Tacoma, Wash.; **Thos. A. Cole**, claim agent Los Angeles Railway Corporation, Los Angeles, Cal.; **A. E. Beck**, claims solicitor, B. C. Electric, Vancouver, B. C.; **A. Molesworth**, assistant claims agent, Portland Railway, Light & Power Company, Portland, Ore.; **L. Frank Gordon**, general claim agent, Oregon-Washington Railroad & Navigation Company, Portland, Ore.; and **J. T. Rupli**, assistant claim agent, Puget Sound Traction, Light & Power Company, Seattle, Wash.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell, Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correlate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

Outline Lighting of Buildings.

One source of great beauty in the night life of a city is the outline lighting of buildings with incandescent lamps. In the memory of the traveler or visitor no more lasting impression can be made, no more pleasing spectacle presented. Where buildings are grouped, as in our World's Exposition, the flood-light system may be superior, but to give the best and most impressive display of a city's greatness, nothing can eclipse, nor even approach the outline system. The use of metal troughing for outline lighting provides a durable, inexpensive and convenient method. The following specification drawn by one of the inspection bureaus of the Coast gives a very good exposition of the method.

Definition: Outline lighting for decorative purposes means receptacles installed above the first story of a building, not more than 36 inches apart and on the outer contour of the vertical enclosure thereof or on the completed underfacing of arches and lintels, and the actual construction between the receptacles.

Troughing: Outline troughing must be made of galvanized metal at least No. 28 U. S. gauge in thickness and must consist of a base and cap each made in one piece. The cap must form three sides of the enclosure and shall include grooves made to confine the edges of the base so as to form sliplock joints and must be secured to the base by solder tacking every twelve inches. Where the contour of a building requires that troughing of special form be used all seams in the special form must be filled with solder. The completed troughing must be free from projecting edges, burs or fins; must be watertight; must be large enough to easily contain all the wires; must be rigidly secured in place and be grounded.

Receptacles: Receptacles must be constructed and installed to conform to all the requirements for receptacles used in metal signs.

Circuits: Metal troughing must not contain any circuit which exceeds 1320 watts capacity or which supplies more than 66 receptacles or which requires more than 15 amperes.

Wires: Wires must be rubber-covered, double-braid; must not supply any translating device except lamps inserted in the metal troughing, and must never be arranged so as to form a magnetic loop. Wires of different systems must not be contained in the same system of metal troughing.

Blind Troughing: Blind troughing may be used to join sections of outline troughing but no section of blind troughing so used shall exceed the shorter of the joined sections of outline troughing. Blind troughing must not contain any receptacles.

Preservative: Metal troughing must be covered, both inside and outside, with two coats of rust-preservative which will not chip, crack or peel off.

NEW ELECTRICAL CODE AT PORTLAND.

After 18 months' labor the new Electrical Code for the city of Portland, was introduced to the city commission on July 15th, and went through the second reading. The committee which has been working on same represented every interest affected.

After their labors were ended the local electrical workers union No. 48 raised an objection to the \$100 cash bond and the \$500 surety bond which must be deposited by an electrical contractor before he can do business in the city.

The object of this requirement was to get rid of the "carpet huggers," etc. The union contended it was too heavy a burden on the small contractor.

A public hearing will be had on the new Electrical Code before it comes up for final passage.

This fight promises to be one in which the union stands alone, with all the other interests, composed of the architects, city electrical department, power companies, electrical contractors' association, underwriters, telephone companies, and telegraph companies, opposed to them and back of the ordinance. Many new features are incorporated in this ordinance, such as the capacity to be furnished is based upon the necessary wattage per square foot, in order to get the proper illumination in various classes of buildings, so that an owner will not overload this wiring when he purchases fixtures, as is the case so many times under the old system of a given number of outlets per circuit, without any regard to the class of building or the location in the building.

When same becomes a law we will endeavor to give a comprehensive outline of it.

The reason there is so much feeling over the ordinance is due to the fact that the business agent of the union signed the letter of acceptance, which was sent to the commissioners, and now as the union elected a new business manager, he repudiates the acts of the former representative.

Electric Sign Ordinance at Salt Lake City.

A proposed ordinance changing the construction and maintenance of signs from the old bond to a license system was presented to the city commission Wednesday by Commissioner H. W. Lawrence and laid over for one week. It is to be taken up for action next Wednesday. The new measure does away with the expensive bond system under which merchants in the past have had to furnish bonds aggregating millions of dollars to guarantee the city against damages in case of accident. Under the new arrangement a license fee will be charged for erection of all signs and an annual inspection fee will have to be paid. From the revenues thus received the city will, by resolution, set apart a certain percentage to pay damage claims in case of an accident from a sign.

The ordinance requires that a permit must be secured for erection of any sign over, in or about any street or public way in the city. All signs extending more than two feet out from the property line must be constructed of metal or other non-combustible material and must be illuminated with at least ten candle power per square foot of exposed surface. No piece of glass with an area of more than one square foot can be used in the exposed surface of any projecting sign. Every sign shall be placed at least ten feet above the surface of the public way over which it hangs and the building end shall not be more than two feet from the building. Signs erected after August 1st must not extend more than ten feet from the building in full length. It is further provided that after August 1st all signs hanging out from buildings and not illuminated must be illuminated or taken down. The ordinance also requires that all illuminated signs must be kept illuminated at least seven hours each week. This is to do away with a lot of dead signs which are now never illuminated.

The fees provided are as follows:

For signs projecting from buildings: For construction, \$3; for inspection 8c per sq. ft. up to thirty sq. ft. and 6c per foot above that. For roof signs and those parallel with the buildings: For construction, \$2; for inspection, \$1 per sq. ft. If the sign is illuminated there will be an additional fee of \$1 for the first five lights and 5c for each additional light. All fees are payable in advance save the inspection, which is paid immediately after the inspection is made.

TRADE NOTES.

Fire destroyed the mill of the New Ladysmith Company situated at Nanaimo, B. C., during the early part of last week. The loss which was fully covered by insurance, is estimated at \$30,000. It is anticipated that the mill will be rebuilt.

The Willamette Pulp & Paper Company, Oregon City, is installing a 20 in. double-suction centrifugal pump, Platt Iron Works make, for pumping pulp. This is to be driven by a 125 h.p. General Electric motor. The pump was sold by Chas. C. Moore & Company.

The Puget Sound Traction, Light & Power Company of Seattle, Wash., has just placed an order with the Electric Storage Battery Company of Philadelphia, for 34 "Ironclad-Exide" batteries of 3 cells each. These batteries are to be used for lighting the cable cars operated by the Traction Company.

The Coast Power Company, Portland, is installing a steam-electric plant at Tillamook, Oregon. Included in the equipment is a 300 h.p. Lyons Safety boiler, sold by Colby Engineering Company, Portland, and a Curtis 3-phase turbine generator, 2200 volt, direct connected. The plant equipment is being installed under the direction of C. J. Edwards, manager of the company.

NEW CATALOGUES.

Electric Winches and Winding Drums are the subject of Bulletin No. 48901 from the Sprague Electric Works of the General Electric Company. The illustrations of their industrial application should be especially suggestive to plant managers.

Catalogue No. 22 from Pass & Seymour, Inc., of Solvay, New York, illustrates and describes Handy Electrical Wiring Devices manufactured by this company. The noteworthy feature of the catalogue is the use of colored pictures to illustrate the special finishes in which the metal parts may be supplied.

The Electric Storage Battery Company, Philadelphia, has issued a supplemental price list and bulletin, showing types of "Chloride Accumulators" for fire alarm, signal, telegraph and automatic time clock services. It has been prepared especially for the use of contractors and dealers.

Busch-Sulzer Bros. Diesel Engine Company is distributing from their San Francisco office in the Rialto Building, an interesting publication, descriptive of the operation of Diesel engines manufactured by this company in the plants of the Texas Power & Light Company at Cleburne and Sherman, Texas.

The Sprague Electric Works of General Electric Company is now mailing pamphlets as follows: No. 441, Sprague Watertight Floor Boxes; No. 951, Stage Floor and Wall Pockets; No. 950, Plug Connectors; No. 953, Iron Shutter Color Disc; and No. 952, Strip Lights, Proscenium, Border and Foot Lights, these last three being pamphlets relating to theatrical devices. The various devices are fully described and detailed.

The following publications have recently been issued by the Westinghouse Electric & Manufacturing Company: Ad Leaflet No. 103, contains a description with illustrations of the cutout showing a young girl in a standing position representing the well known figure adopted by the Westinghouse Company, designated as Dorothy. This cutout, which

is lithographed in six colors, can be used with a display of any heating device or fan. One arm is hinged so it can be moved to various positions. Window displays showing the cutout demonstrating electric fans and heating devices are also illustrated and described. Descriptive Leaflet No. 3723, describing Baldwin-Westinghouse industrial locomotives, shows a number of installation views of this class of apparatus, and a description of the characteristics of the locomotives is also given.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The Bay Shore Railroad Company has applied to the commission for a certificate of public convenience and necessity authorizing it to construct an electric railway line from the intersection of Voltaire and Bacon streets, San Diego, northeasterly across the entrance of False Bay to Pacific Beach. The authorized capital stock of the company is \$200,000, of which \$7000 has been subscribed. Upon the granting of the necessary franchises and permits, the company proposes to apply to the railroad commission for authority to issue sufficient capital stock to finance the project.

The commission has rendered a decision authorizing the San Joaquin Light & Power Corporation to issue promissory notes in the sum of \$249,967.13 to renew other notes outstanding. Steps are now being taken by this corporation to pay off its floating indebtedness of \$1,615,661.13, and to provide funds for new construction.

The Montecito Railroad Company, Los Angeles, has filed an application with the commission, asking authority to issue and sell 50,000 shares of its authorized capital stock at the rate of 90 cents a share. The company proposes to construct an electric railway line from the north end of Griffin avenue, Los Angeles, to the summit of Montecito Hill, a distance of 2¼ miles. The company proposes to acquire certain property at the upper terminus of the line to be used as an amusement park.

The commission has rendered a decision granting authority to the Campbell Telephone Company of Campbell, Santa Clara County, to reissue 27 shares of capital stock. This stock is to be issued in lieu of 27 shares illegally issued without the consent of the Railroad Commission. The company also applied for authority to issue and sell additional shares of stock from time to time for the purpose of constructing lines and installing telephones in new territory. This portion of the application was dismissed by the commission pending the securing by the telephone company of a certificate of public convenience and necessity.

The commission has made an order granting the San Joaquin Light & Power Corporation additional time in which to issue the \$1,776,000 of bonds which it proposes to pledge as security for certain 2 year 6 per cent collateral trust notes. The authority, as now granted, will expire December 31, 1914.

The commission has made an order granting the Home Telephone Company of Covina an extension of time in which to issue the \$87,700 bonds previously authorized by the commission. The telephone company will have until August 1, 1915, to take advantage of the commission's authority.

The Oro Electric Corporation has filed an application with the commission asking authority to extend promissory notes totaling \$71,960.23 for a period not exceeding 14 months from July 15, 1914. These notes were given by the corporation during 1913 in partial payment for goods and merchandise furnished it during the construction of its plant in the neighborhood of Stockton.

The commission has made an order extending the time within which the Central California Gas Company may issue the \$12,500 of common stock authorized by the commission on February 17, 1914. The authority under the order just made is extended from July 1, 1914, to and including January 1, 1915.



NEWS NOTES



FINANCIAL.

SALT LAKE CITY, UTAH.—The board of directors of the Utah Power & Light Company declared their regular quarterly dividend last week on the outstanding preferred stock of the company on a basis of an annual dividend of 7 per cent. The amount of dividend for immediate distribution is approximately \$130,870. The Guaranty Trust Company of New York was selected as the register and transfer agents.

SAN FRANCISCO, CAL.—The stockholders of the Northern California Power Company at a recent meeting authorized an increase in the capital stock of \$2,000,000 6 per cent cumulative non-assessable preferred of which it is intended to issue at present only \$500,000. The half million preferred will be put out at 80 and offered to common stockholders for subscription in the ratio of one share of preferred for each 20 shares of common now held. The new money is needed to develop additional markets.

SAN FRANCISCO, CAL.—The Spring Valley Water Company has asked the Supervisors sitting as a board of equalization to reduce its assessment on properties in this city from \$6,865,497 to \$3,993,744. The company states that its franchise is now assessed by the State Board of Equalization at \$2,500,000, but that Assessor Ginty has increased its assessment upon its tangible properties by this sum in order not to lose the revenue. It claims that if the present assessment is allowed to stand that it will be paying its tax upon the franchise twice.

INCORPORATIONS.

SANTA FE, N. M.—W. Goff Black and associates of Aztec, Farmington and Denver, have filed articles of incorporation of the Aztec Irrigation Company, with capitalization of \$800,000. The company takes over the rights of the Inca Canal & Irrigation Company, owning valuable diversion rights on the San Juan.

LEWISTON, IDAHO.—The Farmers' Inland Telephone Company has been organized to build and operate an independent telephone system. The principal place of business is at Melrose, Idaho, and the capital stock is \$2000, divided into 100 shares. The officers are C. J. McConnell, president; H. R. Croson, secretary, and the four directors are: Lee Lucas, S. S. Sardan, Geo. L. Johnson, and E. F. Stamper.

RENO, NEV.—Articles of incorporation have been filed at Carson with the Secretary of State for the Portneuf Power Company. The principal place of business is Reno. The purpose of the company is to acquire and sell electric power for lighting, heating and power purposes. Capital stock is \$100,000, divided into 100,000 shares of a par value of \$1 each. The incorporators are A. D. Ayres, E. C. Dalzel and D. C. Papson.

WALLACE, IDAHO.—A railroad is to be constructed in Shoshone County to be known as the Emerald Creek Railroad by an Idaho corporation with principal place of business at St. Maries. The line will start at a connection of the Milwaukee railroad in the southwest corner of the county and run in a southerly direction along Emerald Creek for a distance of about 25 miles. The system may be steam or electric. The company is incorporated with a capital of \$25,000 which has been fully subscribed by the incorporators, Fred. Herrick, A. V. Bradrick and E. B. Flagg, all of St. Maries.

ILLUMINATION.

HILLSBORO, ORE.—Fire destroyed the power plant of H. V. Gates in this city on July 17th, entailing a loss of \$15,000.

SONOMA, CAL.—The Chamber of Commerce has entered a campaign for an ornamental street lighting system for the business district.

BEAUMONT, CAL.—Beaumont has called a special election to authorize the issuance of \$10,000 in bonds to go into street grading and street lighting.

REDLANDS, CAL.—The city trustees are taking steps looking towards the acquisition of an electric distributing system. The contract for street lighting expires December 1st.

SHOSHONE, IDAHO.—The Beaver River Power Company has been granted a franchise to distribute electricity in this city. Current must be delivered by the expiration of 18 months.

CANBY, ORE.—The council has granted a franchise to M. J. Lee for an electric plant. It is planned to have the plant in operation within 60 days. The plant is at Meadowbrook and lines will be run to Canby.

NEHALEM, ORE.—The election for the issuance of \$12,500 in bonds for the purchase of the local water system, the construction of a reservoir, and for the building of an electric light plant by the municipality carried.

NOGALES, ARIZ.—The Nogales Electric Light, Ice & Water Company has applied for a franchise for the distribution and sale of electric current. The ordinance commission has the matter under consideration.

LAPWAI, IDAHO.—The foundation of the new concrete building for the Lewiston Electric Company is being laid. Work of setting poles and stringing the wires has progressed to a point about eight miles out of Lewiston.

SANDY ORE.—The Portland Railway, Light & Power Company has been granted a franchise to supply electric power and lights in Sandy. The company will construct a cable line from Sandy to the Bull Run power plant and construct a transforming plant.

TEMPE, ARIZ.—The council is contemplating municipal ownership of an electric power and lighting system. An engineer is to be employed at once to make estimates of the cost of the present Southside Gas & Electric Company's system, also of an entirely new system.

SPOKANE, WASH.—Trent avenue property owners are planning to install a decorative system of electroliers from Lincoln to Division streets on the south side similar to that proposed by Morton McCartney, city engineer, and under similar terms to that proposed for First avenue.

PULLMAN, WASH.—A campaign for lower rates for electrical energy has been launched by the Pullman Chamber of Commerce. M. C. Osborn, commercial agent of the Washington Water Power Company, the supply company, traveled to Pullman in order to confer with the representative of the chamber. The Chamber of Commerce has also been negotiating with several companies to install a plant here.

SALT LAKE CITY, UTAH.—The contract for the lighting fixtures for the new State Capitol Building was awarded by the Capitol Commission to Mitchell-Vance Company of New York City. The cost of the fixtures will be \$25,000. The principal fixtures is an immense chandelier 13 ft. in diameter containing 240 lights which will be suspended from the dome of the capitol by a chain the length of which will be 1 ft.

RIDGEFIELD, WASH.—J. H. Cunningham and S. D. Stofer, Spalding building, Portland, who have a franchise to construct and operate water works and a lighting and power plant here, are preparing to begin work on the project early in August. The water works are to comprise wells, pumping plant, reservoir and distributing system in which

wood pipe will be used; and the lighting plant is to be steam-electric, current from which is to be used for pumping water as well as for lighting.

STOCKTON, CAL.—Since January 1st the Stockton Division of the Western States Gas & Electric Company shows an increase in connected business of 1555 kw. lighting load, and 1593 h.p. motor load. During this period the company's electric output has shown an increase of 13.7 per cent over the corresponding period of 1913. At the present time there is 3 ft. of water going over the dam at the company's hydro-electric development on the American River and the indications are that the water supply will be hountiful throughout the summer.

SANDY, ORE.—An ordinance granting the Portland Railway, Light & Power Company a franchise to supply electric power and lights in Sandy has passed the council and was signed this week by Mayor Meinig. The company will spend between \$4000 and \$5000 in constructing a cable line from Sandy to Bull Run power plant and in erecting a transforming plant. If the contract for street lighting is passed the company will build the cable at once. It is expected to have the cable completed by September 1st.

WALLACE, IDAHO.—The installation of flaming arcs in the business district and the lighting of resident districts with 400 c.p. tungsten lamps, and the lighting of the hillside with 250 c.p. lamps was outlined to the council at the last meeting by representatives of the Northwest Light & Power Company, and the matter referred to the light committee. The recent installation of cluster lights through portions of the business district, however, is greatly in favor at the present time and the saving to the city by the new system is stated to be only nominal. It is thought that the report of the light committee will not be favorable.

LOS ANGELES, CAL.—New protests have been filed with the city clerk, for presentation to the city council, against the electric power rates fixed by the board of public utilities' rate resolution No. 11, which went into effect July 1 and which demands, says the protest, a payment of 50 cents per kilowatt-hour in addition to the regular charge for current used, in certain cases. The protests allege that the provision cited will aid power companies to freeze out the small and isolated plant; that it is exorbitant and would cause many plants to be put out of commission, and that it fosters a "power trust" and kills competition.

SALT LAKE CITY, UTAH.—Active construction of the illuminated floats for the electric parade of the Wizard of the Wasatch is in progress at the Wizard's workshop in Salt Lake City, under the direction of Miss Emma L. Mulkey, the expert float architect and designer, who has been retained by the directors of the organization for this season's carnival, which will be celebrated August 25th to 29th. The electric parade will have sixteen floats and 500 characters. Utah materials and Utah workmen are employed exclusively in the production of the floats. Those who have had the privilege of seeing the partially constructed floats are unanimous in the prediction that this year's electric pageant will be the most magnificent spectacle ever presented in the city.

SALT LAKE CITY, UTAH.—The Capital Electric Company has been awarded the contract by the Oregon Short Line Railroad to install a gigantic electric sign on the roof of the Union Depot of the Oregon Short Line and Salt Lake Route in Salt Lake City. On the south end of the depot the words "Salt Lake Route" will be spelled out in full in 36 in. letters, and on the north end of the depot the words "Oregon Short Line" will be spelled out in full in letters of the same size. Between the two signs the Union Pacific shield will be outlined in lamps with colored caps with the words "Union Pacific System" written diagonally across the face of the shield. This shield is 18 ft. wide and 24 ft. high. The lower half will carry the illuminated dial of a clock. The shield will contain 688 lamps and the two signs on either side

will contain 319 lamps, making a total of 1007 lamps. Twenty-five watt lamps will be used in the letters and 15 watt lamps in the balance of the sign.

TRANSMISSION.

McMINNVILLE, ORE.—A new concrete dam will be built at the city power station. The structure will cost \$4000.

SPOKANE, WASH.—The Austin-McCain Company, electrical engineers, of Spokane and others, have been granted a franchise for a power line from Danville to Republic, a distance of 30 miles. The line completed will cost approximately \$30,000. They will begin work at once.

PRESCOTT, ARIZ.—M. P. Jewett of Phoenix has purchased an electric plant at Wickenburg, built by a subsidiary corporation of the Octave Gold Mines Company. He proposes to modernize the plant, and supply electric power to mining districts in lower Bradshaw mountains, including Octave, Yarnells and others. The plant is located 8 miles from the Octave mine.

EL CENTRO, CAL.—Surveyors of the Knights Engineering Company have completed surveys for the location of substations and electric distributing systems in the town-sites of Seeley and Dixieland for the Holton Power Company. The Knights Company will supervise the construction of a terminal station at El Centro, to be used for the new 55,000 voltage line of the Holton Company.

EDMONTON, ALTA.—Messrs. Sanderson & Porter of New York and San Francisco, financiers and builders of hydroelectric plants, have submitted a proposal to the city of Edmonton, Alberta, to furnish power from a plant to be erected at Moose River, B. C., in the Yellowhead Pass of the Rocky Mountains, 250 miles west, at prices ranging from one cent per kw-hr. for the first 50,000,000, to a half cent per kw-hr. when 120,000,000 is reached. The plant, to be installed on a branch of the Fraser River, will cost \$3,500,000. Its minimum capacity is placed at 300,000,000 kw-hr., transmitted to Edmonton over cables. The transmission lines will follow the railroad. The present cost of producing electric power in Edmonton is 1¼ cents per kw-hr. This, Mayor McNamara announced a few days ago, is to be reduced to 1½ cents. Two million dollars has been invested in the municipal-owned plant now in operation.

FALL RIVER MILLS, CAL.—Arrangements for the California Power & Manufacturing Company to assume charge of the local power plant owned by Florin Bros., were made by E. B. Bumsted, official of the California company, who was here recently. Charles Kormel, local manager of the company, is making negotiations for the purchase of the stock of the Fall River Company, a local concern, but the stockholders are undecided about selling. Post hole diggers have reached a point nearly half-way between Fall River Mills and McArthur, and poles for the power line are being delivered continually. Power for irrigation will be available in time to do only slight good this season to the grain and alfalfa, which are the main crops of the valley. Many hundreds of acres of land on the plains will be made into meadows under the additional irrigation by power. This will greatly increase stock raising from which many fortunes have been made here.

SALT LAKE CITY, UTAH.—A telegram received here by officials of the Utah Power & Light Company indicates the early completion of the work of rebuilding the transmission pole line running from Park City through the Wasatch mountains into the Salt Lake Valley via the company's power plants on Mill Creek canyon, southeast of Salt Lake. The transmission line extends from Park City to Eureka, Utah, and a large force of men is at work changing the cross-arm construction on the poles and restringing the wires. It is one of the most important improvements in service undertaken by the Utah Power & Light Company throughout the portion of its territory served by this trans-

mission line. Every power plant in Utah owned by the company is being utilized to furnish power for the company's transmission and distribution lines. With the completion of the big power houses on Bear River some of the smaller Utah plants have been relieved of a portion of the work they have been doing and the greater part of the "load" on the company's lines is assumed by the new power houses. This resulted only in a curtailment of the hours of operation of some of the smaller plants in Utah. None of the latter power houses, the officials say, have been shut down, however, nor is this likely to occur at any time in the immediate future. On the contrary, word from the general offices of the Utah Power & Light Company indicates that with a future development of the market for electric service throughout this section corresponding in any degree with the development of the market during the past eighteen months it will be necessary to operate every power plant to capacity within a very short time. The improvements and extensions to these power plants during the past year have amounted to hundreds of thousands of dollars and in addition to the regular work they are now doing, they form a power generating reserve for the Utah Power & Light Company that will make it possible for the company to handle a steady increase in the extension of its service without trouble.

TRANSPORTATION.

SANTA ROSA, CAL.—Bids are being taken for a franchise for the proposed Healdsburg electric railroad. It is about 10 miles long and will serve Alexander and Dry Creek valley sections.

BAKER CITY, ORE.—Promoters of an electric trolley line between Baker and Richland with a local car system have been busy here and in Eagle Valley for the last few weeks and there is a possibility that such a line will be built.

SALT LAKE CITY, UTAH.—To keep pace with the progress and the growth of Salt Lake, twenty-four new steel passenger cars, representing an expenditure of approximately \$200,000 are being put into service on the various lines in the city by the Utah Light & Railway Company.

VANCOUVER, B. C.—The B. C. Electric traffic figures for June show a falling off of 872,968 passengers on Vancouver and suburban lines compared with June of last year. The figures were: June, 1914, 3,274,636; June, 1913, 4,147,604. The check to the city for its percentage of the earnings was \$6,495.97 compared with \$7,076.01, a decrease of \$580.04 as compared with the same month last year.

TWIN FALLS, IDAHO.—The Twin Falls Commercial Club has decided that the Idaho Pacific Railroad must be built, and 17 business men have decided to go among the citizens of the city and solicit stock subscriptions and donations. The plans of the company were presented to the meeting by President A. L. Swim. An electric line to Castleford, thence through Hagerman and on to connect with the Oregon Short Line north of the river is projected. It is proposed to raise \$100,000 by donations and sale of stock.

SAN FRANCISCO, CAL.—At the annual meeting of the stockholders and directors of the United Railroads the former board of directors was re-elected without change, as were the officers, as follows: Directors—A. W. Foster, Henry T. Scott, Washington Dodge, A. H. Payson, J. C. McKinstry, B. S. Guinness, John A. Buck, L. P. Sherman, C. N. Black, George B. Willcutt and J. W. Lillenthal. Officers—President, Jesse W. Lillenthal; vice-president, C. N. Black; secretary, George B. Willcutt; treasurer, A. M. Dahler. Jesse W. Lillenthal held the proxies of all stockholders and cast a single vote to effect the election of directors.

SAN FRANCISCO, CAL.—Waiting for the approval of the supervisors and the State Harbor Commissioners, a company of Chicago men, represented in San Francisco by F. A. Curtiss, is endeavoring to secure the right to build an elevated

railroad from the Ferry building to the Exposition grounds. According to the plans, the road will start from the second floor of the north end of the Ferry building and run along the Embarcadero to Bay street. Turning west it will run to Polk and Bay. The city intends to use the block bounded by Polk, Bay, North Point and Van Ness avenue as a terminal for the municipal lines and the proposition is to use the second floor as an elevated road depot.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company now have plans in preparation for the erection of a freight and passenger terminal station south of the general office building on West Temple street. The company recently purchased a lot with an 85 foot frontage adjoining its general office building at a price of nearly \$70,000, the purchase being made during the time when the company's application for a freight and express franchise was pending before the city commission. Now that this franchise has been granted the company is proceeding with its plans for the erection of a freight and express terminal to accommodate the traffic from its Holiday, Murray, Sandy, Midvale and Centerville lines.

WATERWORKS.

LEWISTON, MONT.—The contract for the construction of the gravity water system to replace the present wooden pipe line has been awarded to A. M. Holter of Helena, Mont., at \$62,977.

BEND, ORE.—The Bend Water, Light & Power Company will shortly begin the construction of a new reservoir, which will be situated on the hill above Kenwood and will have a capacity of 100,000 gallons of water.

FERNIE, B. C.—The Crow's Nest Pass Electric Light & Power Company, Limited, will apply to the comptroller of water rights for the approval of the plans of the works to be constructed for the utilization of water from Elk River.

CULDESAC, IDAHO.—The city last week voted in favor of issuing bonds to the value of \$10,000 in order to purchase the water plant of the Culdesac Water Company. Although but a light vote was cast, the majority favoring the purchase was substantial.

SAN FERNANDO, CAL.—The Board of Public Works has submitted a report on the acquisition of a municipal water plant for fire protection. It recommends the purchase of a well north of the city limits on Seventh street, laying of pipe lines, and the purchase of 3000 ft. of fire hose. The cost is estimated at \$22,000.

TWIN FALLS, IDAHO.—Definite action toward securing a new water system for Twin Falls was taken recently by the city council in conference with its committee and F. C. Horn. The plan of piping water from the canal system, taking it from the ditch at the spillway and carrying it in wood pipes to the distributing system here was determined upon. The matter is now in the hands of the attorneys who are preparing papers to call an election to authorize a bond issue of \$300,000. It is thought that the cost of the new system can be kept within \$250,000.

SALT LAKE CITY, UTAH.—A complete test of the city water mains to determine just how much damage has been done and is being done by electrolysis is to be made at once by the city water department. Several months ago a piece of water main was dug up by the water department and was found to have been almost eaten away by the stray electric currents. It had been perforated in several places. Investigations led the water officials to believe that such damage might be extensive and so it has been decided to make a thorough survey of the distributing system. Having made such a survey the water superintendent will report to the city commission with such recommendations as he deems necessary to check the damage and guard against it in the future.

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BY F. H. NEWELL.

HYDROELECTRIC DEVELOPMENTS ON PUBLIC LANDS IN RELATION TO IRRIGATION

B. E. C. FINNEY.

EFFICIENCY ENGINEERING FOR A POWER COMPANY

BY E. A. WEST.

HISTORY OF ELECTRIC TRANSMISSION

BY G. O. WILSON.

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IRRIGATION MANAGER AND HIS LEGAL PROBLEMS

BY F. H. NEWELL.

(A comprehensive treatment is here given of the water situation in the Western States, particular stress being laid upon the economic use of water as the determining factor in its assignment. Illustrations are given of the speculative evils which have occurred under the desert land and Carey acts and of their elimination by the reclamation act. Mr. Newell is Director of the U. S. Reclamation Service.—The Editor.)

The engineer or business man who is placed in responsible charge of an irrigation project has not only many duties connected with the purely physical side of maintaining the works and of distributing the water, but also he has dealings with hundreds of farmers. In these the most complete diplomacy and experience in human nature are none too good to insure

tions are established. This condition arises from the fact that the water laws in many of the states are very defective, being unsuited to the needs of the people. There are few states in the arid West in which there has been provided a well-considered and logical body of legislation. Most of the laws or customs are dependent upon court decisions, each of these



Diversion Weir for a Western Irrigation System.

success. Growing out of these relations are almost innumerable matters pertaining to legal requirements and the manager must continually exercise discretion in questions of mixed legal and physical fact.

While it is not expected that the manager should be a lawyer, yet he must know enough of the fundamental principles of water laws, at least, to be able to state these clearly and to avoid litigation, especially over trivial matters. There is a saying in the irrigated West that "water is worse than whisky in making trouble." There is also another phrase, that of "winter friendship," implying that during the crop season every man is at warfare with his neighbor, and it is only after the crop season is over that friendly rela-

resulting usually from some peculiar case. Thus they have often been apparently contradictory and inapplicable to ordinary affairs.

There are certain well established fundamentals, however, which should be recognized in every irrigated region, namely, those pertaining to the right to appropriate and take water from a stream, also the superiority of prior appropriations and the limitation of all appropriations to beneficial use.

In any general statement, it is, of course, impossible to cover the intricacies of the subject and in fact it is desirable to keep out of these and to try to obtain a broad view of some of those matters which are fundamental in the management of projects of various

kinds. In the following pages these are touched upon in a broad way, simply as indications of the questions which have been large in the minds of various managers.

Water Rights.

The extent and limitation of water rights is a subject of never-ending discussion in many irrigated communities. Through the lapse of time, the more important of these questions gradually become settled, but in minor details they continue to arise. In order to discuss them intelligently, especially with men from the humid region, it is necessary to have clearly in mind that the conditions which have prevailed in the older states, notably those pertaining to riparian rights, do not exist in the arid West.

Most of the states of the Union, excepting those within the arid region, have adopted in one form or another the principles of English common law regarding waters, the effect of which is to safeguard to the owner of land, through or along which a stream flows, the continuation of this stream undiminished in quantity and unchanged in quality. This conception, which has gradually crystallized into law in most English-speaking countries, is opposed to the conservation and use of the waters of the arid region. If put into effect, it would prevent the irrigation of any considerable amount of land, as the watering of such land must necessarily result in diminishing the flow of some stream.

In a few of the Western states, particularly California, which has an arid and a humid portion originally settled by different types of people, there is more or less conflict of law and of court decision. For example, in the northern or humid parts of the state, there has been a tendency to adhere to the doctrine of riparian rights, while in the far southern, especially in the localities settled by the Spanish, the doctrine of appropriation and use of the water was adopted by the pioneers without question. In other states, however, which are wholly within the arid region, the common practice confirmed by legislation has been for the first comer to appropriate and take for use on his land as much water as he needed; the next comer taking a portion of what was left, and so on, the first in time being first in right, and this right being limited by beneficial use on the land.

There is also a difference to be recognized in these rights. Uses of water for domestic and municipal supplies are superior to those for irrigation. In turn irrigation is superior to manufacturing and development of power, so that in case of conflict there is usually first considered the needs for the support of human and animal life, next those for food supply and the growing of plants, and third, the industries.

The irrigation manager can hardly be expected to go into these matters in detail, but he should at least have clearly in mind a few of the fundamentals of this character, and be fairly well acquainted with the state laws and decisions concerning the water rights pertaining to his particular project.

Beneficial Use.

The Reclamation Act of June 17, 1902, concisely embodies the maxim "that the right to the use of water acquired under the provisions of this act, shall

be appurtenant to the land irrigated and beneficial use shall be the basis, the measure, and the limit of the right." In other words, although a man may have acquired an amount of water equal say to three acre-feet in depth on his land, yet if through any cause, such as seepage, his land does not require three acre-feet, he cannot sell or dispose of the excess, but must confine his demands to that amount of water which he can beneficially apply, any excess going back into the general stock to be utilized by those next in order of time.

At a conference in Salt Lake City, Utah, in November, 1913, a definition of beneficial use was attempted as follows:

A water user with a vested water right limited to beneficial use is entitled to that amount of water that will render him a reasonable maximum amount of good with a reasonably economic handling of the water. Since he has acquired his vested right from the laws of his state, he is entitled to protection of that right by the state; but it is his duty to the state, and the people of the state have the right to demand of him that he use every reasonable method to reduce the amount of water required to a minimum.

This demand requires the water user:

- a. To make reasonable preparation of the ground surface for irrigation.
- b. To use good judgment in selecting appropriate methods of applying the water to the ground.
- c. To prepare reasonably efficient dikes, ditches and structures to get the water over the land in such a way as to reduce the underground losses to a minimum.
- d. To irrigate the ground with such a head and at such intervals as to require a minimum use of water for proper irrigation.
- e. To cultivate the irrigated ground when practicable to prevent undue losses from evaporation; in some cases possibly to govern the character of crops to be grown.

It is evident that the reasonable degree of perfection of each of these requirements will vary with the locality and with different changing conditions in each locality, so that the beneficial use of water is a variable.

Economical Use of Water.

Since the water supply available for irrigation in the Western states is adequate for only a relatively small percentage of the entire irrigable acreage, the fundamental standard of economical use must be the financial results accomplished per acre-foot of water applied rather than the yield per acre irrigated. It, therefore, becomes both necessary and desirable to impress irrigators with the fact that in general the largest net profits per acre-foot of water applied are obtained, not from using excessive quantities, but from more careful use of relatively small quantities.

In developing a more economical standard for the use of water, it should not be presumed that established rights can be limited to less water than they would carry under the accepted rule of beneficial use yet by constantly bearing in mind that the ideal ultimately necessary must be the highest net profit per unit of water applied, irrigators may gradually be induced in many instances, to obtain for themselves these results, and those undertaking the construction of new projects may be induced so to design their systems as to provide a liberal water supply during

the development period with a view to ultimate development based on economic use.

In the history of irrigation in this country, there has been evident a gradual but very definite evolution in the ideas of what constitutes proper use of water. While the use of water for irrigation was at first a relatively unimportant one, its importance now overshadows all other uses, save that of domestic supply.

In the course of this evolution, the doctrine of beneficial use has become established, but in future development this doctrine must in many cases merge into, or be supplanted by that of economic use.

able small structures become obstacles to the economic conduct of the work.

To guard against such contingencies, the character of the title to the right of way should be kept fully in mind, and the limits plainly marked with permanent stones or monuments, so that there can be little opportunity for controversy to arise regarding the exact position of the boundaries. Wherever possible, the right of way of the main canal and of its principal branches should be fenced to prevent encroachment of cattle and to establish beyond question the matter of proprietorship and control of the land.



Typical Irrigation Canal.

"The doctrine of beneficial use looks to individual interest; that of economic use to the general welfare of society as a whole. So far as possible, water charges, systems of distribution, and regulations should be so adjusted as to make the interest of the individual water user coincide with this public interest."

Rights of Way.

The canal system and various structures occupy certain tracts or parcels of land, the title to which has presumably been obtained before the works are completed. The character of ownership or possessions of each tract should be carefully scrutinized by the irrigation manager to ascertain whether the right of way involves the complete ownership of the land or is simply an easement for a particular purpose.

In the case of complete ownership of the lands acquired for right of way, vigilance must be exercised to see that encroachments are not made upon these lands. There is a tendency for individuals to erect small structures, bridges, water wheels, outbuildings, and various devices upon the right of way, and by sufferance obtain vested rights to the enjoyment of the use of the property. Sooner or later, there is necessity for changes or repairs to the canal, and these innumerable

Desert Land Act.

The legal basis for title to irrigated land in the arid region rests on a number of Federal laws, the most important of which are the Desert Land Act, the Carey Act and the Reclamation Act. In addition, large areas of land have been acquired by individuals under the terms of the homestead and other acts and by corporations under the grants made to transcontinental railroads or to states of the swamped and overflowed lands donated to the latter for purposes of reclamation.

The Desert Land Act was the first distinct recognition by Congress of the need of irrigation in the development of the West. It provided in effect that any individual might select 640 acres, afterwards cut down to 320 acres, on condition of irrigating a portion of this land. The terms are very liberally interpreted and under them large areas of lands passed into the hands of individuals and corporations without the actual reclamation and cultivation of any considerable portion. In fact, at the present time, the great bulk of the land taken up under the terms of the Desert Land Act still remains in its desert condition and is being held either for speculative purposes or forms the larger part of extensive grazing ranges of cattle and sheep companies.

It is unfortunately the case that the lands which have been granted to the states for reclamation, such as the swamp and overflow lands, and those transferred to individuals under the Desert Land Act under conditions of irrigation, have both failed very largely of that purpose, because of the lack of enforcement of the requirement of actual reclamation and the substitution therefor of so-called "constructive" reclamation in the sense that proof has been offered and accepted without actual verification of the facts.

The irrigation manager is concerned in this matter largely in knowing that certain lands with title have been obtained through reclamation under the terms of the Desert Land Act, have not necessarily been reclaimed and do not therefore always possess complete water right.

Carey Act.

Under the terms of the Carey Act of 1894, certain Western states were allowed to select upwards of a million acres, lately increased in some cases to two or three million, under condition that the state would arrange for their irrigation either directly by the use of state funds or by agreement with some corporation. The latter has been the invariable rule; the lands thus selected by the state have been the subject largely of speculation by investors more interested in the immediate profits of handling the lands than in the actual development of them.



Past and Present Pumping Methods.

The state officials are supposed to safeguard the interests of the future settlers and see to it that the works built are properly planned and completed; that there is an adequate water supply, and that the charges made for water are reasonable. As a matter of fact, the state officials charged with this duty are those who are already overloaded with other duties, who have no special knowledge nor experience in this class of work, and who through lack of continuity in office cannot make use, for any considerable time, of the experience gained.

The results which have followed the attempts made under the Carey Act illustrate the fact that a difficult and complicated business of this kind cannot properly be intrusted to ex officio trustees or directors elected for political reasons and serving for short terms. It is as impossible to achieve good results in irrigation as it would be to operate a manufacturing establishment or a railroad line, under similar conditions of control.

The consequences have been as might be expected.

Many experiments have been made, large sums invested, some works completed, most of the projects in bankruptcy, and general confusion resulting. In time, after reorganization and several new starts some of the works have been put in fairly good shape. Meantime, many of the settlers have become disheartened, and the irrigation managers in charge of the works have had extreme difficulty in developing any consistent system of operation and maintenance under the changing administration or control of the work.

Legal questions which arise in this connection are, of course, of such far-reaching and difficult character that the best of legal talent is none too good. The irrigation manager must have access to competent and well informed lawyers experienced not only in the state laws regarding irrigation and Carey Act projects, but also with the Federal laws having to do with the acquisition of title under the conditions existing.

It is, of course, impossible for the irrigation manager to have more than a very general oversight in these matters but he must be kept continually informed on the details and seek for guidance in order to keep as clear as possible of the almost innumerable complications which arise where financial troubles exist and where the settlers feel that they have not been fairly treated.

Reclamation Act.

Under the terms of the Reclamation Act of June 17, 1902, the United States has invested certain funds derived from disposal of the public lands in the construction of irrigation works. The lands which at the time of the beginning of the works were in public ownership are disposed of under the terms of the Homestead Act to actual settlers and in small tracts. The government having ample funds for building the works, has constructed them with a degree of thoroughness and permanence not practicable for the corporate investor. It has thus set certain standards of construction which have been followed in part by later private builders. It has also given more attention to the question of providing an adequate water supply. Being relieved of all questions of profit and of interest returns on the project, it has been possible to build substantial works at less price than could be done by the private investor.

The irrigation managers under the government works, utilizing the experience of older organizations, endeavor to put into effect systems of operation and maintenance based upon sound agricultural and business practices. In this respect, a standard has been set as in the case of construction of the works themselves. The legal questions which come to the cognizance of the manager are relatively simple as compared to those which may come up under the somewhat confused conditions on the larger private projects.

The Federal law itself is relatively simple and explicit as regards the building and operation of the reclamation works. The acquisition of title by settlers under the terms of the homestead act has been the subject of many decisions, so that most of the questions which arise have been determined and definite information and advice can usually be had on these points. The manuals provided by the General

Land Office and by the Reclamation Service enable the manager to secure a fairly good idea of these legal difficulties and while it is not expected that he will be immediately involved in them, he can at least obtain such broad knowledge as to be able to avoid some of the pitfalls which exist where the legal conditions are less well known and developed.

Cultivation Requirements.

The requirement of cultivation imposed by the Desert Land Act, the Carey Act and many similar laws, has been general in character, and has not always been enforced. Thus relatively little of the land, the title to which has passed from the government under conditions of cultivation, has actually been put to use in producing crops. The object of the men in obtaining lands under these laws has not always been to



A Western Electric Pumping Plant.

make a living or a profit out of the sale of products of the soil, but on the contrary to gain for themselves the unearned increment in value of the lands by subdividing and selling them in small tracts or of consolidating them in large holdings for future advance in prices.

This condition should be borne in mind in considering the general economic development of the country and in comparing statements of products from areas alleged to be reclaimed but not actually tilled with the average crop production on well cultivated lands. It illustrates also the fact that in all questions of irrigation management, there must be had for guidance reliable statistics concerning degree of cultivation and its relation to the actual amount of crop produced in order to obtain intelligent views concerning the real benefit of irrigation.

Residence Requirements.

The residence requirements, as in the case of those of cultivation, have as a rule been cut down to the very minimum, and even then have not been strictly observed. On some of the Carey Act projects the minimum term of residence has been as low as 30 days, so that it has been possible for a man living in town or in another state to take his summer vacation out on his "homestead" and acquire title by a few weeks camping on the selected spot. Under the terms of the

Reclamation Act, however, actual, bona fide residence of three years is required, the theory being that the expenditure made by the government in reclaiming these lands is justified only by the acquisition of a resident citizenship. If, as in the case of the Carey Act projects, men can come out from centers of population, spend a few weeks on the ground, then acquire title, go back to the cities, there results a sparsely settled area with a population composed mainly of tenants. The state is thus deprived of the increase in resident land owning citizenship, essential to its continued prosperity.

It is of no particular benefit to the community as a whole after the work has been built to have the lands held by non-resident owners and cultivated by tenant farmers. The soil is generally impoverished, under the renting system. The local improvements such as roads, bridges and schools are neglected, the towns do not receive normal growth, and the great investment made in bringing water to the land is of relatively little use as the irrigation system is not furnishing water to more than a small proportion of the land which it can supply.

On the other hand, it is urged that the requirement of actual residence on the ground is extremely onerous and that especially in the case of orchard development, years are required before the farm is put on a producing basis. Meantime, it is asserted, the owner should be permitted to live in town or in some other state and put a part of his earnings into the improvement of the farm.

This theory is excellent if it is based on the facts, but a relatively small percentage of non-resident owners do invest their earnings effectively in their farms. Far greater damage is being done to the lands by the careless handling of the soil and water by renters so that at the end of a few years the owner seldom finds that he has a farm which is worthy of his personal attention at least to the degree of living upon it. When it is considered also that most of the young orchards never reach maturity and that, as stated by horticultural experts, probably not more than ten per cent of the orchards which are set out on irrigated land have any commercial value, the fallacy of this theory becomes apparent.

The enforcement of the legal requirement of residence on the part of the manager involves, however, many questions especially where the attempt is being made to put the newly irrigated land in fruit. Where a man and his family are actually living upon the land, as is evident to the neighbors and to the canal riders who pass the place every day or two, there can be no question involved, but, as frequently happens, the owner after setting out fruit trees spends perhaps only a few weeks in the year actually on the place, but claims that his family or a portion of it are residing there or that he has made arrangements with a relative, then there are a number of very nice questions which naturally the manager desires to avoid entering into if possible. It is also questionable whether the manager should be held responsible for the enforcement of the residence requirement and thus be compelled to be both the prosecuting attorney, judge, and jury in matters of this kind. In fact, because of his numerous other duties, this matter of residence re-

quirement, while kept clearly in mind by the manager, should be left to determination by some other authority.

Size of Farm Units.

The success of the farmer is dependent more largely upon the size of the farm which he attempts to cultivate under irrigation than upon almost any other single factor. As a rule, most men attempt to handle more land than they can properly cultivate. The man who has sufficient capital and experience to acquire and till 40 acres is apt to use his capital in making first payments on 80 acres and then diffuse his efforts over the whole tract to an extent such that the yield is far less than it would have been had the owner confined his efforts to 40 acres.

The slow development of the irrigated regions is due largely to the fact that a great proportion of the irrigators are attempting to pay for water for 80 acres out of the products of from 20 to 30 acres which are actually well tilled. The men of average means and intelligence who are making a success are those who are confining their efforts to 40 acres or even less. While there are men who can handle even larger tracts, yet these men are exceptional and their example cannot be urged as typical.

The Desert Land Act set the limit originally at 640 acres to be acquired by one man, and later cut the area to 320 acres. Later the fact became apparent that it was impossible for a man of ordinary means to properly irrigate this area or any considerable part of it. Later, the Carey Act project reduced the limit to 160 acres, and as the lawmakers began to appreciate the true conditions of irrigation, they finally in the Reclamation Act in 1902 placed a limit which "shall represent the acreage which in the opinion of the secretary may be reasonably required for the support of a family upon the lands in question." The lower limit was originally 40 acres, later reduced to 10 acres. When it was appreciated that on some of the lands, especially in the southern arid regions, where the irrigation season extended throughout the year, ten acres was seen to be all that would be needed, under good care, to support a family.

The enforcement of legal requirements regarding the size of farm units rarely comes to the attention of the manager as after the irrigated land is once subdivided and settlement has progressed there is tendency to subdivide rather than to consolidate holdings.

Electric brass-making furnaces are not in regular commercial use in the United States, although experimental melts of brass, bronze and copper have been made in several types of furnaces. Electric furnaces offer the advantage of being gas-tight (preventing the loss of zinc vapor), making possible a neutral or a reducing atmosphere, quicker melts and less labor. Their development has been hindered by the high cost of power, and also of furnace upkeep. The Bureau of Mines is conducting experiments on the design and operation of electric furnaces for brass-melting, the results of which will be published as soon as warranted by the progress of the work.

HYDROELECTRIC DEVELOPMENTS ON PUBLIC LANDS IN RELATION TO IRRIGATION.

BY E. C. FINNEY.

(Among the papers presented at the recent conference of attorneys of the Reclamation Service at Salt Lake City, W. R. King, chief counsel for the service, considers this the most important and of the most vital interest to water users in the West. The following abstract was prefaced by a brief history of irrigation.—The Editor.)

The possibilities and development of electrical energy at irrigation dams and at the drops of irrigation canals is a profitable by-product of irrigation. In 1898 Congress amended the previous act of 1891 by permitting the use of the right of way therein granted for the development of power as subsidiary to the main purpose of irrigation, and by the subsequent act of February 15, 1901, broadly authorized the use of public lands and reservations for all structures and fixtures necessary or incidental to the generation, transmission and utilization of hydroelectric power. This law may be said to have begun the era of development of the water-power possibilities of public domain and to provide necessary legislative permission to those who, reversing the theretofore generally accepted laws of nature, proposed to make water run uphill. The best of the low-lying lands had been covered by gravity irrigation systems, and the settlers looking longingly toward the mesas and mountain slopes not capable of being reached with gravity water, yet possessed of immensely rich soil and adapted by nature to the production of the finest quality of fruits and of practically every crop suited to the locality and climate.

Secretary Franklin K. Lane, at the outset of his administration of the Department of the Interior, turned his attention to the water-power situation in so far as it relates to public lands and reservations. At his instance a measure was introduced and has been favorably reported by the committee on public lands, house of representatives, and it is hoped will receive favorable action during the present session of congress.

The bill, in the event that charges are collected in any project, devotes the entire proceeds to the reclamation of arid lands in the Western States, and further provides that upon return to the reclamation fund of the moneys so expended 50 per cent of the amount so returned shall be paid to the state within which the hydroelectric power occurs, for the support of educational institutions or the construction of public improvements, or both. The bill seeks to protect the investor, encourage investment, secure early development of the water-power resources under conditions favorable to the public, but retains fee or reversion in the United States for such use or disposition as may appear proper and expedient to the people and to congress at the expiration of leasehold periods.

Water power development and irrigation of arid lands in practically all of our Western States are inseparable, or, at least, closely related. Congress thus recognized the importance of utilizing the electrical energy developed in connection with gravity projects for the pumping of water to high levels.

The reclamation law of June 17, 1902, said nothing about the development of hydroelectric power, but

four years later congress recognized the fact that power should be developed and might be necessary for the irrigation of lands under such projects, and provided that in such cases surplus power or power privileges might be leased for periods not exceeding ten years, giving preference to municipal purposes. In many of our existing reclamation projects hydroelectric power development at the dams or drops in canals are used by the United States in the pumping of water to lands above the gravity canals, and in other projects power or power sites have been leased to private individuals or corporations engaged in similar irrigation of high lands.

Cheap electrical power will be of vital importance in another respect in those reclamation projects where drainage becomes necessary and where it is not feasible to reach and drain all of the water-logged lands by gravity, pipes or ditches. For with cheap electric current it will be entirely practicable to drain and keep drained these low-lying areas which would otherwise be rendered worthless for agriculture.

A practical illustration of the utilization of water and power resources is given in a recent paper by Frank G. Baum of San Francisco, where a power company in California stores flood waters in a high dam at an elevation of over 5000 ft. above sea level. After being released from the dam the water passes through a series of six power houses, utilizing a total drop of 4140 ft. for power purposes, generating more than 100,000 constant horsepower, the water being discharged from the last power house into irrigation canals which will accomplish the irrigation of more than 60,000 acres of arid lands.

One of the advantages of pumping by hydroelectric power is that the energy may be furnished by a large distributing plant, which supplies the whole region, and which will thus permit of dividing the work of irrigation among a number of successive stations, irrigating at the outset only those that are likely to pay, keeping pace with the natural growth of the demand for irrigation instead of tying up capital in a complete plant for a long period before it can become productive.

The irrigator whose lands are within the scope of an electric power development derives other advantages from the power so generated than the mere lifting of the water to his lands. The same wires which carry light for his house operate his threshing machine, sawmill, corn sheller and churn, and eradicate much of the heavy and unpleasant labor formerly attendant upon farming. To the irrigator it means a steady and sufficient flow of water whenever desired and wherever pipes are carried uphill or downhill. There is no waiting for a "turn" at the water in a lateral which serves a half-dozen farmers. There are no annoyances from clogged or weedy ditches or broken canals or laterals; nor at the end of the irrigation season is it necessary to turn out to clean and put into condition laterals and canals in anticipation of the new season. Through clean open pipes, which will not clog with vegetation or weeds, which do not break or get tramped out of condition by livestock, a continuous flow of water reaches the exact spot in the farmer's field where it will do the most good, and con-

tinues to flow until the requisite irrigation has been accomplished.

The saving of water is an important and material result of the use of electric pumping and of the pipes through which the water is forced, for it eliminates loss by seepage and evaporation. The experience of many irrigators had already fully demonstrated the value of these, to the West, most important uses of hydroelectric energy. But other developments and uses of this power upon the lands are of indirect interest to irrigation and irrigators.

Lack of markets or inadequate transportation facilities for his crops are enormous hindrances to the farmer of the West. This means not only loss and delay, but in some instances the total failure of his enterprise. The presence of an extensive development of hydroelectric energy in the irrigator's neighborhood may mean factories, manufactories, electrically-operated railway lines, and a score of industries and enterprises which will attract to the vicinity a population which will require and take, at profitable prices, the produce of the land.

It is therefore of vital importance not only to the people at large, but to the farmer upon the irrigated lands of the west, that these resources be rapidly and fully developed, under such laws and restrictions, however, as will preclude this beneficent public utility from becoming a monopoly for the oppression of the people instead of their servant and aid to prosperity.

Far-seeing statesmen propose to retain in the United States the ownership of these valuable power sites for the public lands and reservations, and to procure development through long time and definite leases, thus retaining such control over the future as will enable the American Congress of that day and generation to make new and proper legislation fitting those times and their needs, and thus insuring the greatest and most enduring good to the people generally, but particularly to those of us whose homes are in the West, and whose interests in water and its possibilities are direct and vital. With the full and wise development of the irrigation and power possibilities of the West, her opportunities for increased prosperity and well being are boundless, and will far out-distance the most vivid word picture of our Western boomers.

Denatured electricity, an interesting method of preventing the improper use of electric current, has been devised by an Italian engineer. The practice of making especially low rates for current to be used in electric power, heating and cooking devices is becoming more and more general, but with the ordinary constant potential current it is difficult to detect the use of lighting devices on circuits intended only for power and heating purposes. This engineer advocates the use of special circuits on which the current is subject to extreme fluctuation of voltage at rapidly recurring intervals, which would make it practically impossible to use lamps, because of the flicker in the lights. As the current is not entirely interrupted and the normal voltage is almost immediately restored the proper operation of power or heating apparatus is not interfered with and the rightful use of the circuits for their respective purposes is assured. (Society for Electrical Development.)

EFFICIENT POWER PLANT MANAGEMENT

EFFICIENCY ENGINEERING FOR A POWER COMPANY.

BY E. A. WEST.

(The author, who is efficiency engineer for the Portland Railway, Light & Power Company, shows the application of modern efficiency methods to power plant operation, laying particular stress on the difficulties to be met.—The Editor.)



Old Foreman "Kant Be Dunn" would hold his hands up in "holy horror" if he were told that hereafter he would only be required to watch his workmen and help them get their work out in the time allowed. He would pass away entirely if told the part of a job which was to be done first, the order to be followed, the time

it should be started and the length of time required to do it in. In some cases the man or machine that would do it is named and all this is looked after by a "white collared" crew located in the works office or at headquarters.

The superintendent and foreman of today, however, are not at all surprised at the new "stunts" that emanate from the office; in fact, they, many times, anticipate the office by making suggestions that will bring about better operating or construction efficiencies.

Efficiency—probably next to the term "narrow-minded," (which is always used to classify the person who does not agree with you), is the most abused word in modern vocabulary. Ever since Brandeis opened up on the transportation companies' representatives with his array of efficiency experts in the famous rate case before the Interstate Commerce Commission, a few years ago, every magazine had its fling at scientific management—"motion studies," "cost keeping" have become as firmly fixed in engineering parlance as stresses, strains, volts, kilowatts, etc., and from every quarter "hungry looking" individuals, with the "gift of gab" are haunting the offices of large industrial concerns, ready to put the particular concern so far ahead of itself that the strange thing about it all is that they ever got as far as they did in a business way—the firm I mean.

The writer recently interviewed a young man of this type, who was applying for a position. In his conversation he used in a most promiscuous manner all of the familiar terms and phrases popularly associated with scientific management. Although he had only worked in four places, (about six months in each place) he had never risen above the one hundred dollar mark, his education was extremely limited, and he had positively no engineering nor shop training. Yet he offered to put in a complete planning and cost keeping system in a large street railway shop, employing over two hundred men.

The light and power companies offer a splendid field for the efficiency man. First: Because this

phase of electrical work has largely been developed by men with engineering training, and is, therefore, a scientific product. Second: Because in this day of conservation and regulation every energy is bent to reduce the manufacturing cost of electrical energy. In this connection both fixed and operating costs require careful study. Third: There has not been as much attention paid efficiency engineering by light and power companies as by other manufacturing corporations whose output is measured in terms of pieces rather than energy.

Of course, for a long time, considerable study was made of fuel efficiency, and there is no doubt but that the wonderful savings effected in the boiler rooms of generating plants had much to do with the furthering of scientific studies in other phases of manufacture. For a long time engine room men studied indicator cards and valve design, with some resulting economies. One day some one thought of the boiler room and the coal pile—a heretofore neglected opportunity. Here the studies were not so simple or pleasant as in the engine room with its shiny brass work and tiled floors. The investigator had to have a first hand knowledge of boiler room practice, mechanical design, operating requirements, water, fuel and gas chemistry, with an inclination to dig in and work himself. It is needless to go on. The results of these investigations are too well known for further comment. The underlying thought back or under all this is, that we go along for years pecking at the 5 or 10 per cent items of expense and leave the 90 and 95 per cent items to shift for themselves because of the tremendous or apparently tremendous amount of work that will be involved in straightening them out.

Everything that is said in a general way regarding this whole subject, will only be, and can only be, a repetition of what has already been said, and yet it is extremely difficult to try and outline in a single article, the details of any one scheme. In the writer's experience as an efficiency engineer for one of the largest utility companies on the Pacific Coast, it has been his pleasure to see in the last few years a great many changes made in operating and construction methods that have materially reduced costs.

The writer wants it distinctly understood that he takes absolutely no credit for any part of this work. His position has been rather that of an investigator and watcher. The actual work of developing what efficiency systems have been carried out, has been done by the superintendents, foremen and workmen in the various departments.

The old bugbear "our business is different," has of course cropped up many times in making these studies, and the men who have made these statements are not altogether to blame. Their every day life is taken up with many problems, they have all of their working moments and a great many of the hours that they are supposed to be resting and playing, taken up with the perplexities of getting work done. The very speed at which it is necessary for them to work and the fact that their noses are right down to the grindstone, has in many cases been the reason for their not

putting into effect ideas that they have had pigeon-holed away in a corner of their minds, as things to be accomplished. They were unable to carry out their ideas for lack of proper time in which to make the necessary studies and developments. The efficiency engineer, and his force of cost accountants, comes in handy at this point in the every day work of the busy foreman and superintendent, because he is more or less of a free lance and can turn his energies and those of his cost accountants toward solving and working out the problems of the foremen and superintendents.

It might appear from the foregoing that the efficiency man's path is strewn with roses, and that all he has to do is to take the suggestions of the men on the firing line and formulate them, much as the writer does who takes ideas submitted to him and builds a story. This is not the case however. Many times the suggestions that come involve several individuals or departments and it is the getting together of these departments on a single footing that makes the difficult part of the efficiency man's work. I think that no where else in the world does the word and meaning of "inertia" apply so well as it does to the everyday work of the efficiency man trying to bring something around.

When he calls on the "other fellow" to outline some policy, or change or to feel him out, he is usually met with a smile and banished with a frown. The smile because the other fellow does not know just what is coming, the frown because the other fellow usually has a bad taste in his mouth when the efficiency man leaves and the banishment is usually preceded by a whine something as follows: "It seems to me Mr. ——— that there are plenty of other things that can be done in the organization, other changes that are more imperative without your getting into this matter. If you confined your efforts, etc., etc."

Sometimes, too, it is necessary for the efficiency man to recommend changes which will not mean a saving in dollars and cents but will necessitate an outlay of money that often times looks, on the face of it, like a needless expenditure. Recently a matter came up which called for either purchasing and installing a particular class of machine or having certain work done outside at an additional cost to the company of several thousand dollars a year. It was proven that out of 574 articles used by the company, some 318 could be made by installing this certain piece of apparatus. Much pressure was brought to bear in favor of the installation of this apparatus by some department heads, and the apparent saving in sight was not a myth, but could be made an actual reality. However, after going into the matter with every one concerned the efficiency man had to recommend that the machine idea be abandoned for the reason that, although it would be possible to save from \$3000 to \$4000 a year, the establishment of a machine by the company might mean a loss of \$12,000 or \$15,000 in revenue due to the loss of consumers running plants that turned out this kind of work. In fact the labor element might become involved in the matter also, as most all of the larger establishments of this kind are strongly unionized. His decision was also influenced by the fact that a competitor in the field in talking to prospective

customers that did this kind of work, could use as an argument in favor of their company, the fact that they had all of their work of this class done by the outside firms.

All of the phases surrounding matters of this kind must be looked into by the efficiency engineer very thoroughly before making a recommendation. Many times his viewpoint is altered after he has looked at the commercial side of the matter. His best work comes in when he gets all hands together on a proposition of this kind and explains the reasons for or against it. In large corporations, where so many different departments exist, only one phase of a supposed change may present itself and a department may go ahead and institute a change which will play havoc with the work of another part of the organization.

Co-operation and co-ordination, two of the stock phrases of the efficiency expert, are likewise his monitors in all he undertakes.

"Cost keeping" and "cost analysis" are two of the necessary tools of the efficiency man, but cost keeping alone, even though accurately conducted, will not do the work unless the reasons and why of every item shown are gone into. As an example—at one time the hole digging crew of the line department used the trolley cars in going to and from their work. The transportation department objected to the use of front or rear platforms of the trolley cars by the hole diggers on account of the shovels and digging bars, that had to be carried, soiling the clothes of the regular passengers. It was decided that a light automobile truck should be pressed into service to take care of the hole digging crew. The cost per hole, under the old arrangement, for travelling time and street car fare, averaged about 26 cents; using a light truck the cost jumped up to pretty nearly one dollar, due to the fact that the automobile expense and the driver's expense had to be added to the lost time of the hole digger.

At a conference in the general line foreman's office one day, when the matter of unit costs were being investigated and discussed, the suggestion was made by the line foreman that a lighter automobile could do the work just as satisfactorily and instead of having a driver, the hole digging crews' foreman could handle the machine himself and take the men to the various locations and pick them up. The suggestion was acted upon with the result that the cost of digging holes, transportation and lost time, dropped down to 16 cents which, it is seen, is considerably less than the original cost when trolley cars were used, and considerably less than when the light truck was used. Inasmuch as there were some five hundred holes dug per month, the difference in the two costs amounts to quite a saving.

I use this to illustrate the fact that the costs were accurately kept when the hole diggers were using the trolley cars and were accurately kept when the hole diggers were using the automobile and that any rise or fall in the average cost per month, or per week, or per job, was gone into to find out why it differed from the standard costs, but, that even though these costs were checked and used as a check on the crew, there was still a better method lying around the corner that would reduce costs further.

This is analogous to the adoption or installation of a new kind of a machine tool in a factory. The tool replaced may have done its most efficient work but cost three times more per unit than the new tool.

In light and power companies, the line and underground departments, arc lamp department, meter department, electrical construction and maintenance departments can all be lined up and put on an efficiency basis by first bringing the men, in charge of these departments, to a realization of what scientific management means. Second by having them bring their individual workmen into the proper attitude and third by impressing upon each and all that the company is not entering into any slave driving practice, but that the object point in view is to increase rather than decrease wages and fourth that every change made by the men that produces a saving, should be taken into consideration and the men receive some other reward than a mere "thank you." Increased efficiency should always mean increased pay. Any saving made by the men for the company should be split up on a basis that will allow the men a substantial return for the efforts they have put out to bring about efficiency.

Pumping California oil is accomplished by several kinds of power whose relative importance has been determined by the U. S. Bureau of Mines as shown in the following table:

Field.	Steam.		Electricity.		Gas Engines.		Compressed Air.		Total
	Beams.	Jacks.	Beams.	Jacks.	Beams.	Jacks.	Beams.	Jacks.	
Coalinga	335	13	66	...	487	10	...	...	911
Lost Hills	45	...	5	...	21	...	...	31	102
McKittrick ^a	150	19	14	...	90	8	30	...	311
Midway	217	...	350	...	200	...	50	100	917
Sunset	181	10	...	...	40	...	25	50	306
Kern River	790	255	96	300	12	154	92	...	1699
Santa Maria	94	9	...	...	130	...	...	7	240
Summerland .....	...	122	...	...	...	...	...	...	122
Santa Paula	5	...	...	...	30	295	...	...	330
Newhall .....	...	...	...	...	7	69	...	...	76
Salt Lake	60	...	25	...	155	...	50	...	290
Los Angeles .....	...	27	...	10	...	383	...	...	420
Whittier-Coyote ...	66	32	3	...	...	29	...	12	142
Puente	4	20	...	...	...	30	...	...	54
Fullerton	148	29	...	...	45	64	...	17	303
Total	2095	536	559	310	1217	1042	247	217	6223

^a Includes Belridge.

^b Includes wells in which agitators are used.

^c Compressed air used in steam engines in place of steam.

The waste of water in irrigation varies from 10 to 90 per cent, according to conditions. In storage reservoirs 10 to 60 per cent evaporates, in main canals 17 to 45 per cent is lost by seepage and evaporation and in distribution canals from 30 to 50 per cent. Finally from 10 to 15 per cent is wasted by surface run off. Most of this waste can be eliminated by pipe line or covered and lined ditch.

The U. S. Government exhibit at the Panama-International Exposition in San Francisco has been divided into sixteen grand divisions or sections, representing all of the executive departments, except one, and seven independent offices and commissions. The departments to be represented by exhibits are State, Treasury, War, Postoffice, Navy, Interior, Agriculture, Commerce and Labor, and the other divisions comprise the Civil Service Commission, the Isthmian Canal Commission, the Library of Congress, the Smithsonian Institution, the Commission of Fine Arts, the Government Printing Office and the American National Red Cross.

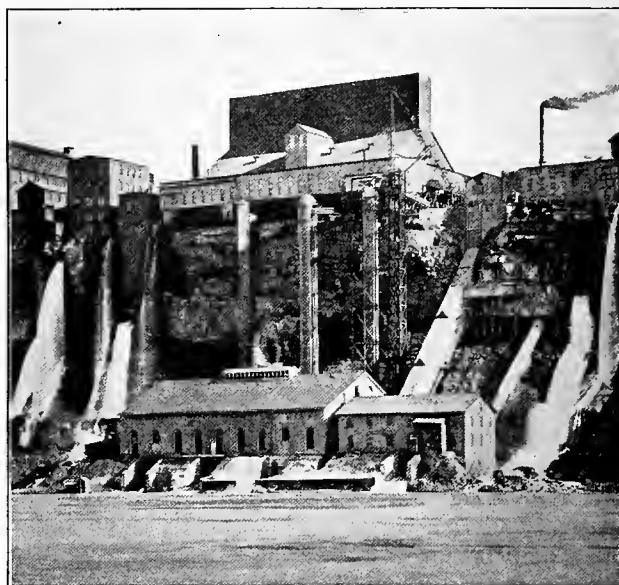
HISTORY OF ELECTRIC TRANSMISSION.

BY G. O. WILSON.

[Continued.]

(In this instalment Mr. Wilson relates in an interesting manner the pioneer developments at Niagara Falls, comparing their importance with the early transmission projects of the West and South.—The Editor.)

While all of these plants were important as beginnings of the development of power transmission in this country, by far the greatest work of this period was done at Niagara Falls, in the beginning of the development of the mighty power available there. For many years engineers had realized the enormous op-



Plant of Niagara Falls Hydraulic & Mfg. Co.

portunities for development, and as early as 1861 a canal was built through the town of Niagara Falls for the purpose of developing hydraulic power at the edge of the gorge, below the falls. In 1872 the rights to the power from this canal were purchased by Messrs. Jacob Scholckopf & Son, who founded the Niagara Falls Hydraulic Power & Manufacturing Company. At the start this was simply the operation, under one management, of separate water wheels at the plant of each consumer; but the owners of the enterprise soon saw the advantage to be derived from a system of central production and distribution of power, and in 1881 they had erected what might be called a central station, with distribution of the power generated by means of belts, shafts, and ropes to a number of factories along the edge of the cliff. The wheels in this power plant were only capable of utilizing 50 ft. of the available 210 ft. fall; and when, a few years later, an attempt to utilize 75 ft. was made, a great deal of trouble was experienced. By the end of the year 1896, however, when a new power house was completed by this firm, with 4500 kw. of electrical equipment, the full 210 feet of head was utilized.

While this company was thus developing, another great Niagara concern was getting under way. In 1886 the Niagara Falls Power Company was incorporated for the purpose of deriving a vast amount of power from the waters of Niagara. In 1889 a subsidiary company, the Cataract Construction Company,

was formed for the purpose of doing the actual construction of the hydraulic and power equipment at Niagara. The plan of this company was to draw water from the river at a point above the falls through a canal 500 ft. wide and 1500 ft. long, constructed through the town of Niagara Falls. At a depth of about 250 ft. below the surface a tunnel 6700 ft. long was to be bored, with its portal at the base of the gorge below the falls. Hydraulic turbines were to be placed in pits at about the level of this tunnel, the water from the canal being carried down these pits in steel penstocks, passing through the turbines, and discharging into the tunnel, which acted as a great tail race.

Professor George Forbes of London was engaged as the consulting electrical engineer, and Professor W. C. Unwin as hydraulic engineer. In commenting editorially on the fact that the chief engineers for this and other large power projects in this country were most all from Europe, the *Electrical World* accounted for it by saying that the rapid development of lighting and railway work here had prevented us from keeping pace with Europe in power development. And it is a fact that practically all the "Power Notes" in that journal from its initial volume in 1883 until 1889 were in regard to railway developments or lighting.

At the outset of the Niagara project, all manner of wild schemes were brought forward. It was suggested that it would be cheaper to place the whole plant in a cavern in the rocks immediately back of the falls, drawing the water either vertically down from the river above, or through pipes stuck up so as to dip into the under edge of the great mass of water pouring over the falls, so as not to deface them in any way. The engineer in charge of the Frankfort line thought that transmission of the power from Niagara to New York, and even 500 miles to Chicago, would be perfectly feasible at 50,000 volts and an efficiency of 60 per cent. Many engineers urged that it would be more economical to develop only hydraulic power with the water of the canal and tunnel; the water to be sold to individual consumers, with the privilege of constructing individual pits at their plants, and placing therein turbines to drive their machinery through long shafts to the surface, the water being permitted to discharge into the Cataract Company's tunnel.

This last plan was adopted by the owners of the canal as a part of their scheme of development, and indeed the first power developed was 3300 hydraulic horsepower sold to the Niagara Falls Paper Company, who started their turbine in 1894. But Prof. Forbes, who had visited all the principal electrical power plants in the world, recognized the value of a great central station for the generation of electrical power, and accordingly set about to design the greatest one in the world. The generators, of which three were to be installed at first, were of 5000 h.p. capacity each. Prof. Forbes designed these generators to be of the revolving field, or "umbrella," type, two-phase. He strongly advocated a frequency of only $16 \frac{2}{3}$ cycles per second, but yielded to the storm of criticism this evoked from engineers all over the world, and raised this to 25 cycles. Even this was decried as being too low, on account of the size of transformers which it

would necessitate; but Professor Forbes showed that this increased transformer cost per h.p. was mythical, on account of the very large transformers which would be necessary anyway to handle the great power developed.

To understand how thoroughly modern and progressive Prof. Forbes' design for these great generators was, it is only necessary to remember that when seven similar machines were installed in 1898 and 1899, they were of substantially the same design, in spite of the wonderful progress in the electrical art in the intervening years, and to remember, also that those ten generators are still in successful, continuous operation today. In view of this fact, it is a sharp contrast to know that he was afraid to trust his transmission system to overhead wires, but insisted on a costly tunnel for the local distribution, and wanted to build it all the way to Buffalo.

It might be noted here that at the very outset of the scheme, the promoters called for the opinions of two of the most prominent engineers in the world, Lord Kelvin in England and Prof. Rowland of Johns Hopkins in America, as to the best electrical system to adopt, and both reported in favor of direct current. Rowland was subsequently converted to Forbes' scheme of low-frequency alternating current; but Lord Kelvin persisted in his predictions of ultimate ruin up to the very instant of successfully starting the plant.

In 1891 bids for the power house, with its great wheel-pits 240 ft. deep, and the large generators, were called for. In 1892 Forbes and Unwin came to America to consult with the directors of the company. After this conference it was announced that in addition to the American plant at the town of Niagara Falls, a similar large plant was soon to be started on the Canadian side. It was stated that this project would be cheaper for the company, as 100,000 h.p. could be developed with a tunnel only 800 ft. long; and that the power developed at this Canadian plant would be the power transmitted to Buffalo, for three reasons: (1) because the Canadian plant would be nearer to Buffalo than the one at the town of Niagara Falls by several miles; (2) because the power generated at Niagara Falls would be all used by the local manufacturing plants building there; (3) 100,000 h.p. could not be consumed in that part of Canada for many years. This scheme was never carried out by the original promoters, however, for in 1901 the only plant on the Canadian side of the river was a small, obsolete plant of only a little over 1000 h.p. capacity.

In the latter part of 1892 the canal in Niagara Falls was completed, and early in 1893 the tunnel was also finished. About the same time the contract for the first of the three great generators was let to the Westinghouse Electric and Manufacturing Company. Contracts for the other two soon followed, and on April 5, 1895, the first machine was successfully started and a mechanical test made. On July 1st, the first current was sent over the wires to the Pittsburg Reduction Works, to test the line, and by the first of September all of the power available at the power house, i.e. 10,000 h.p. was being delivered to the Pittsburg Reduction Company, the Carborundum Company and the Buffalo and Niagara Railway.

With this ready market for its power close at hand, the company could afford to be independent in its dealings with the city of Buffalo in regard to securing a power franchise. The city council attempted to place onerous conditions on the entry of the company's lines into the city; but after more than a year of bickering, that body finally consented to a contract under which the company felt that it would be commercially practicable to operate.

The twenty-six mile line to carry the power to Buffalo was designed for an ultimate capacity of 10,000 h.p. to be carried on a double three-phase line, one set of three wires being mounted in a horizontal plane on each side of the pole, and complete transposition being effected every five poles. The poles used were from 35 to 65 ft. high, and at the start only one of the three-phase circuits was installed, the other half of the cross-arm being left unoccupied.

This was hailed as the greatest transmission project in the world; but as a matter of fact the West already boasted several projects equally important, from the point of view of voltage used, power transmitted, or distance of transmission.

The original San Antonio plant transmitted almost as much power over a greater distance. In 1895 the Portland Light & Power Company transmitted 1350 kw. fourteen miles to Portland at 5500 volts, and in the same year the Folsom-Sacramento power line was put into operation, transmitting 3000 kw. 22 miles at 11,000 volts. The 750 kw., three-phase generators in this plant were the largest three-phasers built at that time, although the 5000 h.p. two-phasers had been installed at Niagara.

Still another plant started in 1895 was in Nevada county, California, where a plant was built to supply power for mines, 1000 h.p. being transmitted a maximum distance of eight miles. This was one of the few California projects in which two-phase generation and transmission was employed.

Early in 1896, before the contract for the Buffalo line was let, a hydraulic development at Hidalgo, Mexico, was transmitting 1200 kw. a distance of 23 miles at 10,000 volts; and the San Joaquin Electric Company of Fresno was transmitting 1020 kw. a distance of 34½ miles, the maximum length of commercial transmission in the world at that time, the voltage being 11,000. Still other projects larger than the Niagara-Buffalo transmission at the time it was opened, from the point of view of amount of power transmitted, were the Big Cottonwood plant, transmitting 1800 kw. at 10,000 volts 14 miles to Salt Lake City, and a plant in Guatemala, where 1300 h.p. was transmitted 22.5 miles at 10,000 volts.

Nor were these large early developments confined wholly to the West. The large water powers in the South were early put to work driving the cotton mills, and in 1894, 3000 h.p. was being transmitted 2½ miles at 3500 volts, from a river power plant to a cotton mill near Pelzer, S. C. In 1896 a smaller plant was put in at Anderson, S. C., 150 kw. being transmitted six miles at 5500 volts; and in the latter part of the same year 5000 more h.p. was developed at Pelzer and transmitted 3½ miles.

[To be continued.]

LETTER TO THE EDITOR.

Municipal Lighting Burden.

To the Editor:

The superintendent of the municipal lighting plant of Seattle has repeatedly stated to the public in print that the municipal lighting plant is not a burden to the taxpayers, but, on the contrary, is paying all of its operating and fixed charges in cash, besides accumulating a surplus and depreciation reserve fund.

A careful study of the annual report of the Lighting Department issued for the years 1912-13 and abstracted in your issue of July 11, will disprove this statement. It will be necessary to go somewhat thoroughly into the published figures in order to arrive at the truth. In the report will be found data showing the number and kind of lamps used for street lighting at the end of the year 1913. As the result of a study of this data, the following table has been prepared:

No.	Kind.	No. Lamps.	Watts.	Kw. Demand (At lamp).	Annual consumption based on 4000 hrs.*
1179	5-lamp clusters.....	5895			
337	3-lamp clusters.....	1011			
137	1-lamp posts.....	137			
	Total cluster.....	7043	50	352.15	1,408,600
6365	Series incandescent....	6365	50	318.25	1,273,000
306	Series incandescent....	306	350	107.10	428,400
767	6.6 Amp. arcs.....	767	430	329.81	1,319,240
70	Viaduct lamps.....	70	50	3.50	14,000
	Total series lamps.....			758.66	3,034,640
	Total series and clusters.....			1110.81	4,443,240

* According to the report of the superintendent.

The efficiencies of the street lighting system are not given in the 1912-13 report, but are given in the 1911 report. It is assumed that these have not changed and are as follows: For the series system, 86.3 per cent, and for the cluster light system, 79.1 per cent from lamps to substation. With these efficiencies, the demand of 1110.81 kw. of the street lighting system at the lamps becomes 1324.3 at the substation, and the kw.-hr. consumed at the lamps 4,443,240 becomes 5,206,969 kw.-hr., at the substation.

Furthermore, the maximum demand of the entire street lighting and commercial systems at the substation is given as 9625 kw., of which 1324.31 kw. is the street lighting demand, and this is approximately 13.8 per cent of the delivered power for street lighting and 86.2 per cent for commercial lighting and power, including lighting and power for municipal buildings. The report also states that the total power of the system delivered at the point of consumption was 26,306,861 kw.-hr., of which 4,799,670 kw.-hr. were delivered to the street lights. The rate charged to the taxpayers for this street lighting is 4.5 cents per kw.-hr. and at this rate 4,799,670 kw.-hr. would produce \$215,985.15 per annum. The financial report, however, shows that the street lighting revenue for 1913 was \$211,013.65—the discrepancy being due no doubt to the fact that some of the five-light cluster posts have been burning only three lamps instead of five, which was done in order to keep down the excessive cost of street lighting. The total revenue of the department for 1913 from the sale of current is given as \$904,763.07, of which \$211,013.65, or 23.3 per cent, was collected from the taxpayers through the charges for street lighting and \$693,749.42, or 76.7 per cent, is the revenue that was obtained from the sale of current to commercial and other consumers, including lighting and power for use

in public buildings of the city and for other municipal purposes, which of course was also paid by the taxpayers.

The following data based on the report will show at a glance how the taxpayer is being burdened in order to swell the revenues of the department.

The financial statement shows that a total of \$245,089.99, or 27 per cent of the gross revenue of the department from the sale of current, came from the taxpayers for municipal services.

	Commercial Consumers.	Taxpayers.	Total.
Maximum load at substations...			9625 kw.
Max. load delivered at substation for commercial use.....	8300.7 kw.*		
Max. load delivered at substation for street lighting.....		1324.3 kw.	
Per cent of max. load delivered at substation for commercial use	86.2%*		
Per cent of max. load delivered at substation for street lighting..		13.8%	
Total revenue from sale of current			904,763.07
Revenue from commercial light and power.....	693,749.42**		
Revenue from street lighting....		211,013.65	
Per cent revenue from commercial light and power.....	76.7%**		
Per cent revenue from street lighting.....		23.3%	
Rev. per kw.-yr. from commercial lighting.....	\$62.82		
Rev. per kw.-yr. from street lighting.....		\$189.99	
Rate per kw.-hr. at consumers' premises, commercial light and power.....	2.53c		
Rate per kw.-hr. at lamps, street lighting.....		4.39c	

* Includes power used for municipal lighting and power purposes other than street lighting.

** Includes revenue from municipal lighting and power other than street lighting.

The above figures show that 13.8 per cent of the utilized capacity of the plant is used for street lighting and returns 23.3 per cent of the total revenue derived from the sale of current, while 86.2 per cent of the capacity used for commercial, municipal building lighting and power, produces 76.7 per cent of the total revenue.

Again, the average rate per kw.-year paid by the taxpayers for street lighting is \$189.99, while private consumers get their lighting service at an average rate of \$62.82 per kw.-year.

Referring to the report, it is stated that 8,289,327 kw.-hr. were furnished for business lighting, and on the same page the estimated maximum load for business lighting is stated to be 3340 kw., and later the revenue from this service is given as \$209,969.93. The report states that the average return per kw.-hr. for this service was 2.757 cents, but the application of a simple division will show that the current figures should be 2.53 cents plus per kw.-hr.

According to the report, the street lighting system consumed at the lamps 4,799,670 kw.-hr., which was at the rate of 4.39 cents per kw.-hr. Why the full allowance of 4.5 cents fixed by ordinance was not collected from the taxpayers is not explained. Against this rate of 4.39 cents per kw.-hr. with a load factor of 4000 hours per annum, the private consumers using light in business houses paid only 2.53 cents per kw.-hr.

The estimated maximum demand load of power customers is given as 3410 kw. and the consumption as 7,396,534 kw.-hr., while elsewhere the revenue is given as \$98,904.96. The average revenue per kw.-hr. is stated to be 1.549 cents. There apparently is an error here, as the division makes the average rate 1.34 cents plus per kw.-hr., while the average rate per kw.-year is \$29.00.

The superintendent says "It (meaning the municipal plant) is in no sense a tax burden."

On October 9, 1912, the Puget Sound Traction, Light and Power Company submitted a bid to the city of Seattle to light the streets of Seattle, in response to a request from Councilman E. L. Blaine. The company offered to furnish the current at its tariff rate of 2.75 cents per kw.-hr., maintain the street lighting system at its own expense and turn the same over to the city in first-class condition at the expiration of the contract, paying 25 cents per pin rental on city poles, and in addition pay the city \$40,000 per annum as rental for the use of the street lighting system owned by the municipality, which was in excess of 10 per cent of the cost of the street lighting system, exclusive of the street lighting system furnished by the property-owners. Taking the efficiencies given by the superintendent in his report for 1911, the Puget Sound Traction, Light and Power Company would have been required on its bid to deliver at the city substation last year 5,206,969 kw.-hr., and at the rate offered by that company (2¾ cents per kw.-hr.) the street lighting service would have cost the taxpayers \$143,192.99, with \$40,000 returned to the city for rentals of the street lighting system, as against \$211,013.65 actually paid by the taxpayers.

If a large surplus was earned in 1913, as alleged in the report, why were the taxpayers burdened with this extra charge? Why are the taxpayers required to pay \$189.99 per kw.-year for street lighting, while the business houses get a rate of \$62.82 per kw.-year? Why are the taxpayers charged 4.5 cents per kw.-hr. for street lighting when business houses are getting a similar service at an average rate of 2.53 cents per kw.-hr.? It is a well-known fact that business houses with the same load factor as the street lighting system are getting their service for 1.5 cents to 2 cents per kw.-hr.

When the rates charged the taxpayers for light and power for supplying the municipal buildings and shops are examined, it is found that the lighting department takes advantage of the taxpayers probably because there is no competition. All of the public buildings pay a rate of 3 cents per kw.-hr. for lighting and 2.5 cents for power, as against 1.5 cents to 2 cents for power charged by the city to private consumers. For this service the department collected from the taxpayers in 1913 the sum of \$34,076.34, which would have cost the taxpayers approximately \$20,000 if the service had been furnished at the same rate that similar service is furnished to private consumers.

If it is true that the municipal lighting plant in 1913 earned a surplus of \$242,257.68, as alleged by the lighting department, why were the taxpayers mulcted out of \$87,820.66? Is not the public being misinformed by the frequent statements of the department that "the taxpayer is in no way burdened to support the municipal plant"? If the department up to and including the year 1913 has earned a surplus of \$810,100.21, has this surplus not largely come out of the taxpayers through the excessive charges made by the department for public lighting and power service?

The assessed valuation of the city of Seattle is \$215,362,151, and this excess charge of \$87,820.60 increased the rate 41 mills.

It is quite evident that an increased burden has been placed on the taxpayers through the increase in the rates for street lighting as shown by the rate charged in 1905, the last year the service was supplied by a private company. At that time the city paid \$66 per annum flat for a 6.6 ampere arc lamp. These lamps were purchased by the city when it took over the private company's street lighting system, and are still in use. A little calculation, using the superintendent's data, shows that the taxpayers are now being charged \$77.40 per lamp per annum for this same service when the current is measured at the lamp and \$89.33 per lamp-year if it is measured in the substation; while the series incandescent and cluster lights are being furnished at a correspondingly greater cost per kw.-hr. than in 1905 and at rates far in excess of the published schedule of the private company.

The report states that "the lighting and power plant has an investment of more than \$5,000,000." Property in Seattle is assessed on the basis of 45 per cent of its value, so that the lighting plant for taxation purposes would show a value of \$2,250,000, and at 43.87 mills would yield in taxes \$109,675, and which of course is lost to the taxpayers. Does this loss in no sense affect the taxpayer?

Furthermore, the City Council of Seattle has adopted a resolution to redeem \$50,000 of bonds of an issue of \$400,000 sold in 1903, to construct the municipal lighting plant. These bonds were sold to the state of Washington and draw $3\frac{3}{4}$ per cent interest, maturing in 1923. The bonds provide that it is optional with the state to permit their redemption before maturity. Recently, Councilman Erickson journeyed to Olympia for the purpose of inducing the state to purchase \$500,000 of municipal railway bonds, the balance of the \$800,000 municipal railway issue. The state declined to purchase these bonds, but consented to the city redeeming \$50,000 of the \$400,000 municipal lighting issue which it held.

The plan to redeem \$50,000 of the bonded indebtedness of the lighting department is well conceived to mislead the public into the belief that the lighting department is, unaided by the taxpayers, paying its way and is strictly on a cash basis. This refunding plan of Mr. Erickson's will result in a direct loss to the taxpayers. Recently the people authorized an issue of lighting bonds amounting to \$425,000 to install a steam plant. These bonds draw interest at 5 per cent. This resolution now proposes to redeem \$50,000 of the $3\frac{3}{4}$ per cent bonds, which do not mature until 1923, and issue \$425,000 of 5 per cent bonds for a steam plant. The lighting department owed the general fund on December 31, 1913, for interest advances for the years 1911 and 1912, \$264,348.52.

The financial report of the department shows on December 31, 1913, under liabilities, the sum of \$222,346.94 due the general fund for cash advanced to pay interest on lighting bonds for the years 1911 and 1912 and for miscellaneous interest. It is very evident that the department is not paying out of earnings, interest on lighting bonds, and that taxes are being collected from the people to pay this interest.

Respectfully,

A CONSTANT READER.

Seattle, Wash., July 24, 1915.

THE TELEPHONE PROBLEM. *

(Discussion by San Francisco Section American Institute of Electrical Engineers of D. P. Fullerton's paper as published in this journal July 18 and July 25, 1914.—The Editor.)

The Chairman (A. H. Griswold): Mr. Fullerton has touched briefly upon many points of the telephone business which could be elaborated almost indefinitely. I recall a little story: A doctor in New York called a doctor in Boston. The operator soon informed him that the fellow doctor in Boston was not in. The New York doctor started to walk away, and the operator said "35 cents please." He said, "What for? I didn't get my party." She said, "No, but the company used \$300,000 worth of plant to find out that so and so in Boston was not in." Now, she was a pretty good operator who was able to tell the doctor that the company had employed expensive apparatus, material and construction, to find out whether Dr. so and so in Boston was in or not. The average operator perhaps would not have done that; but the New York doctor paid his 35 cents and felt satisfied.

On the point regarding the services for which the telephone company is often blamed, you may perhaps be interested in knowing that it is easier and quicker for an operator to complete your connection than to tell you the line is busy. It takes her more time and it is harder work for her to inform you that the line is busy than it is to give you your party.

Another interesting point in the service is the human element in the operating part of the business. Mr. Fullerton said that the operators were put in school and trained for some weeks for the operating service. They are not only put in school, but they are paid to go to school. I don't know what the amount is now, but it used to be a dollar a day to go to school; and their wages increase from that up according to their efficiency and the length of service with the company, and yet many of those operators, those same girls, prefer to go in a department store, and stand on their feet all day and work for \$6 or \$8 a week rather than work in an exchange for considerably more than that. The average wage is \$40 or more; and their facilities are splendid. They have nice retiring rooms; lunches are provided on the cafeteria plan, and at very reasonable rates. It is interesting to note that for some time after the fire the average time that an operator worked for this company was five months. It is perhaps the human element of the business that enters into that—the desire to see people and talk with them.

Party line service, is a very necessary part of our business. It is necessary, as Mr. Fullerton stated, that we develop all classes of service. We advertise universal service—service to everybody; and it is necessary that the cheap service as well as the expensive service be provided. Now it is difficult to make people getting the cheaper service realize that they are not entitled to get the same class of service as the man who is paying for the more expensive type; and it is particularly difficult due to the fact that the majority of the people who are getting the cheapest type of service are not perhaps as well educated or able to realize the reason why the higher class or more expensive type of service should be better. Mr. Fullerton spoke also of the hotel service and the private branch exchange service, and how the company is frequently blamed for errors for which it was not responsible. I would like to take this opportunity to call your attention to the fact that the board of supervisors has passed an ordinance that any man owning a private branch exchange can hire anybody he pleases to operate that exchange—his grandmother or grandfather, or anybody else. Now the average individual who is calling that private exchange does not recognize that somebody's grandmother is operating it, and he looks to the telephone company for that service. Prior to the passing of that ordinance we used to provide those operators, who were trained in the business

and capable of handling that service. We are no longer able to do so, only with the larger users, who recognize the necessity for proper service, and require that we provide them with trained operators.

It might be interesting to some of you to know the limit of error of telephone apparatus. There is in each connection a great number of relays, repeating coils and condensers, and lamps and plugs and cords, and various things of that sort, and a great many soldered connections—in fact many things that might interfere with the service; and yet the percentage of actual calls that went wrong due to circuit trouble is .2 of 1 per cent in San Francisco. When you consider the amount of apparatus and the number of connections required in each call, that is a very low percentage.

A. H. Halloran: It has been interesting to hear of somebody else's troubles. Each one of us thinks that our business has a monopoly of the troubles; and I know that some of the electric power men sitting here have been reminded of similar troubles of their own. Likewise the street railway men are up against the same proposition—that of dealing with the public.

The study of human nature is perhaps the most difficult matter that an engineer has to face. An engineer is used to dealing with materials; his training, except in construction work, does not lead him into dealing with men, with individuals; and when he meets such troubles, he is sometimes at a loss to know just what to do. Tonight Mr. Fullerton and Mr. Griswold have done the very thing that is necessary, and should be done on every occasion; they have come forth and frankly told their troubles, and told of the ways in which they are trying to remedy them. The least each one of us here tonight can do the next time someone complains about the telephone service is to tell some of the things we have learned tonight, and in that way carry on the good work and try to educate the public to the difficulties of this one of the means of serving them.

Thos. Morrin: The telephone business is suffering greatly from the fact of there being absolutely no regulation or control of the use of party lines. I myself have a telephone at home on a party line. I did not feel that I could afford to pay the regular rates, because our service I feel is carried on honestly and conscientiously, within a reasonable limit for the use of the telephone. It is seldom, if ever, that I use it for business purposes unless compelled to; it is used exclusively for household purposes, and by my family only; but we have a great annoyance; and it is very frequent that the other party uses the 'phone for unlimited time; when I say half an hour or an hour at a time I think that is quite ordinary; and there is no possible pleading or influence that we can bring to bear on those parties to allow us, even in an emergency, to use the 'phone for a few minutes, with the privilege of their resuming their conversation later when we are finished. I think, in all honesty to the user and the company, that there should be some means of regulating the party line service so that there would be a fair equality to all parties concerned.

D. P. Fullerton: A few weeks ago we had some heavy storms in the southern part of the state, and one of the telegrams that came in from one of our repairmen located away up the mountains was worded this way: "I want to report that the lines over the Liebre mountains are in a terrible state of condition." That is the position I am in tonight. I am billed for one story, that is, the secretary gave me a paper with one heading tonight; I gave it another, and the paper did not have anything to do with either one of them. I am in a rather "bad state of condition," but for the benefit of Mr. Morrin I want to say this: I think I should have called my paper "The endeavor of the company to do a Christian like job, or the claim that very few people know how to use a telephone." Unquestionably Mr. Morrin knows how to use a telephone, but the party alongside of him does not. That is a thing that I tried to cover in my paper tonight.

Those are the very things that I quoted in this paper from the decision of the railroad commission of the state of Michigan, and they were unable to correct them in any way. The complaint in Detroit was on account of the interference with service, just as you have complained of. The commission went into it, as I quoted in this paper. The contract that you and your fellow subscriber in Michigan signed stated that you were to have, each one of you, four calls a day and that neither of you were to use the telephone over five minutes at a time. You made that agreement just the same as you would make an agreement to lease a house or any other class of business.

We would like to enforce the contract; but I think a little study on the part of anyone here tonight will show that it is almost impossible.

Our great trouble is educating the public; and I will say—and I am not speaking with any animus in any direction towards anyone—our trouble is we do not get the proper support from the properly constituted governing bodies. An instance occurred a few weeks ago. There has been a row in Denver between the people and the telephone company there for some time. A telephone engineer of any experience will tell each and every person that a measured service is the most equitable service. Simply referring to other utilities, when you ride on the railroad you pay so much a mile; when you burn these electric lights you pay so much a kilowatt. When you use your gas you pay so much a foot. When you send your letters you pay so much per ounce or half-ounce—everything is measured except the telephone. Everybody wants all of that for the least amount of money that he can get it. Denver, Colo., was on an entirely measured rate basis, and the cheapest measured rate service in the world; but less than one month ago, without any study, but just a hue and cry from the untrained public, demanded and wiped out all of those reasonable rates, which put the burden on the one that used the telephone, that gave the small burden to the small user, and the big burden to the big user—wiped that all out and established a flat rate, that makes the little fellow carry the burden for the big man. I am satisfied that I can convince—or any engineer can convince you that the system of rates in Denver was proper.

I was glad that one of the speakers took up the question of the method of using the telephone. One of the great troubles that we have is to get people to talk directly into the telephone. Years ago, when I was introduced to anybody and was asked what my business was, I generally threw up my arm and told him I was a telephone man, because I was afraid he was going to give me a wallup. Nowadays he generally says, "What is wrong with my telephone service?" and I tell him right off that he does not know how to use the telephone. Everybody should take the advice of a telephone man as to how to use a telephone. You don't go to the lawyer when you are sick; you go to the doctor. You don't go to the doctor when you are in trouble with your neighbor; you go to the lawyer for advice. Why not go to the telephone man for advice as to how to use the telephone. It will lessen our burdens. The speaker was right when he told about the fellow who holds the telephone at one side and tries to talk in the opposite direction. The telephone is made to talk into. Another thing to bear in mind is that the telephone is made to be answered. It is not made to be put on the wall and ring while you keep talking to someone here. In your own place of business, if you are talking to someone of no moment and a customer comes in, you leave him and go to attend to the customer. You don't know what is on the other end of a telephone. A telephone is a thing to be answered instantly. I don't care who is in my office talking to me when the telephone rings; I even don't ask him to excuse me. I grab the telephone; and I think you will find it is mighty good telephone courtesy to follow that rule.

Thereupon the meeting adjourned.

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Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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In connection with the leading article in this issue wherein Mr. F. H. Newell, director of the U. S. Reclamation Service, makes the statement "the water laws in many of the states are very defective, being unsuited to the needs of the people," the situation in Oregon and in California is of present peculiar interest.

In Oregon Governor West is alleged to be endeavoring to abolish the office of state engineer and the desert land board because of political reasons by means of an initiative measure which will come up at the next election. Strong opposition has been developed among many of the engineering and commercial organizations in this attempt to do away with what is generally believed to be the most efficient and satisfactory administration of water laws.

In California the situation is reversed, as an opposition is endeavoring to defeat a water commission bill to be referred to the voters under the referendum. A short review of the situation with special reference to conditions to be remedied in California may be of interest.

The necessity for a modern water code has been felt in California for many years.

The existing law is a hybrid, without pride of ancestry nor hope of posterity, a grafting of the old English common law of riparian rights onto the deeper-rooted stock of the law of appropriation. For in the West the right of prior use established by the early California miners, antedates the riparian doctrine, imported by the American colonists from England and now firmly entrenched by judicial decisions. Under its provisions, title has been insecure, litigation has been protracted, the distribution of water use has sometimes been inequitable and new developments have been retarded.

Relief is needed.

The proposed law establishes a commission authorized to determine the status of all water rights now in use and prescribes the procedure in appropriating new rights. Any water not in active, present, beneficial use is subject to appropriation at any time, excepting that a continuous period of ten years of non-use is allowed to lands riparian to a stream before this water may be appropriated. The several steps to be taken in the acquisition of rights are fully detailed, from the time a permit is applied for until a license is granted after the commission is satisfied. A filing fee is required; \$500 for power development of from 100 to 10,000 horsepower, and \$1000 for greater development, together with an annual license fee of twenty-five cents for each theoretical horsepower capable of development; for other than power purposes, the filing fee is \$10 and the annual license fee ten cents per miners' inch. After twenty years' private use provision is made for public purchase at a price to be fixed by eminent domain pro-

ceedings. Water rights cannot be capitalized and court review is provided for all commission decisions and revocations.

All those who are well informed about the present conditions agree that the new law will instill scientific management into a procedure now lacking in system and efficiency. It involves practically no new principles, being merely a declaration of the law already defined by the courts.

Much opposition centers about its virtual abrogation of the unused riparian right; whereby the owners of land along the lower stream have been able to prevent the more beneficial application of the water to other lands even though the water is not being used on the riparian lands. Yet the right of appropriation seems to be far better adapted to the needs of irrigation and power development, with which the prosperity of these Western states is so intimately interlocked. Considered from the standpoint of obtaining a maximum economic production at a minimum waste the new bill is intended to bring about true conservation and equity. The broad humanitarian aspect of this question is admirably treated in the leading article of this issue by Mr. F. H. Newell.

But while its evident intention is good its execution is poor. The law might be better administered, and at less expense, by a bureau of the state department of engineering than by a new commission; the qualifications of the commissioners are not clearly prescribed, and other features have been overlooked by its framers.

Although the suggested remedy cannot boast of its antecedents and although tainted with grave suspicions as to its job-creating effects, it still has much good. It represents a great stride forward toward a modern water code, it puts order into chaos, and its omissions can be readily remedied by future amendment. However, its only hope for passage lies in a broad campaign of education among the voters who are indifferent to its effects and likely to defeat it because of their ignorance, for as a whole it seems worthy of support just as the present attempt in Oregon seems worthy of defeat.

"The greatest problem which confronts the (telephone) engineer is to devise a plan to systematically and efficiently educate the public in the use of a (telephone) system." The quotation is from D.

Teaching the Public

P. Fullerton's paper on the "Telephone Problem" recently published in these columns, with the exception that the parentheses are supplied by the editor. In fact, Mr. Fullerton's paper can be re-read with profit by substituting "gas," "electric" or "railway" wherever telephone is mentioned.

All of these great public utilities are designed, constructed and operated by engineers, and it might well be the engineer who teaches the public how to use them to the best advantage. And yet this teaching the public is a far more difficult problem than is generally imagined.

There are many subjects upon which the public need education—the mechanical difficulties in supplying service, the cost of establishing the utility, the long period of no returns on invested capital, the

fair profit on a hazardous business, the necessity for engineering public service commissioners, the false professions of politicians, and finally the best methods of using the service.

The problem is primarily one of engineering salesmanship—engineering, because of the requisite technical knowledge; salesmanship, not of a commodity, but of a service.

The approach should be through every channel by which the utility comes in contact with the public. The man who takes the order for service connection should realize that his order is only the beginning and not the end of the service. The workman who makes the connection, the clerk who makes the collection, and every employee who deals with the public should realize that service must be maintained.

Service depreciates from many causes besides deterioration of equipment. Courtesy and public interest do much to build up confidence and to attract favorable attention. Such spirit should be the particular characteristic of all publicity which the company is given, whether through the press, by means of lectures or with house organs. Courtesy does not mean weakness. When the time arrives for a positive, courageous opinion, it should be given through all these channels with certainty and force.

Mass education is impossible. Public opinion is merely the integration of the differentials or derivatives of many individual opinions. By teaching enough individuals it is possible to finally educate the whole public. This great public is your neighbor. You know that the family next door and the family around the corner are human. You call them your neighbors, you treat them with courtesy and honesty in your personal dealings. They are your neighbors and your friends; they are your public.

The public's failure to comprehend the conditions under which the utility is working is the real cause of the strained relations which too frequently exist between the server and the served. The American people, particularly, are characterized by the spirit of fair-play, and when they know the difficulties under which the utility companies are working they will give the sympathetic hearing which is now denied.

The blame for this popular ignorance lies with the utility. More harm has been done by the policy of silence than by all the attacks of favor-courrying demagogues. Good-will can be cultivated as scientifically as oranges; ill-will can be overcome like any other disease which thrives in the dark. Free, frank, open publicity, the bright light of truth, concentrated intensively on segregated individuals, will cause good-will to blossom and ill-will to wither. Suspicion breeds in the darkness of ignorance, confidence flourishes in the light of knowledge.

These ideas are but suggestions for a scientific plan to be followed in securing the co-operation of the public with the company in furnishing satisfactory service. The details must be worked out to fit the needs of each community, but it is believed that these general principles are universally applicable. They show that better public relations can be established by effective publicity, which is largely a matter of engineering psychology, an intelligent directing of the forces which move the human mind.

PERSONALS

W. R. Pounder, representative of Hubbard & Co., at San Francisco, has returned from a trip through Oregon.

R. E. Frickey, engineer with the Northern California Power Company, Redding, Cal., spent the past week in San Francisco.

H. A. Miller, a contractor of Pasadena, California, spent a few days in San Francisco enroute to his home town from a visit to Alaska.

T. E. Bibbins, local manager General Electric Company, San Francisco, is on an extended trip through the mountain region of California.

P. B. Hyde, representative of Thos. A. Edison Company, San Francisco, left during the week for an extended business trip through the Pacific Northwest.

H. H. Hughes, salesman with Westinghouse Electric & Manufacturing Company, San Francisco, has returned after a two weeks' trip to Monterey Bay region.

W. W. Lane of the Western Electric Company's Los Angeles branch, has returned from an extended trip to Honolulu, where he combined pleasure with business.

George D. Smith, supervisor of agencies of the General Vehicle Company, New York, was at Seattle, Wash., during the past week, and also visited British Columbia.

G. B. Rosenblatt, in charge of mining operations for Westinghouse Electric & Manufacturing Company, located at Salt Lake City, was a recent visitor to San Francisco.

Ben Mitchell, engineer for the Utah Copper Company, Salt Lake City, who has been in California for several days, left San Francisco during the past week for home.

A. J. Moan, general manager specialty department, H. W. Johns-Manville Company, New York, is a recent arrival on the coast and recently spent several days in San Francisco.

O. A. Schlesinger, manager San Francisco office United States Light & Heating Company, is visiting the Pacific Northwest and was at Vancouver, B. C., during the past week.

H. W. Turner, president of the Washington Electric Supply Company, at Spokane, and of the Montana Electric Company at Butte, has returned to Butte from a visit to Seattle.

Arthur Walser, district manager motor department of the General Electric Company at Denver, has returned from a visit to the company's factories at Schenectady, Pittsfield and Lynn.

Alex. Friedman, manager Titan Electric Supply Company, Montreal, Canada, is at Vancouver, B. C., with the object of starting a Western branch for the company in the Pacific Northwest.

J. W. Young, representative of the Kerite Wire Company, New York and an old time signal engineer is visiting the Pacific Coast on a business trip and spent last week in San Francisco.

G. Douglas Jones, electrical engineer, with the state engineering department, Sacramento, Cal., who has been spending the past two weeks in San Francisco, returned home the latter part of the week.

Hylon T. Plumb and **Robert Miller**, engineers in the Salt Lake office of the General Electric Company have recently returned from a meeting of the company's engineers at Schenectady and Pittsfield.

H. W. Cope, director of exhibits Westinghouse Electric & Manufacturing Company for the Panama-Pacific International Exposition, San Francisco, is at Pittsburg on matters pertaining to the exposition.

Kenneth Macken of Talton Place, Vancouver, B. C., who has been attending the Rensselaer Polytechnic Institute for the past four years, has returned to Vancouver, having received his degree in electrical engineering.

John Montgomery, commercial agent of the Western Canada Power Company, with headquarters at Vancouver, has been visiting with old acquaintances in Salt Lake City during the past week in the course of a three weeks' vacation.

Miss Laura C. Addison, electrical economist with the Washington Water Power Company, Spokane, Wash., will demonstrate the advantages of electric ranges to prospective purchasers. The company has purchased from the General Electric Company 100 ranges.

E. J. Simons, manager The General Machinery Company, Spokane, Wash., purchased from the Washington Water Power Company during the past week \$190,000 worth of second hand machinery and construction equipment, and 54 cars have been requisitioned to bring it into the city from the Long Lake dam site.

E. L. Dee, special lamp salesman for the Western Electric Company's Salt Lake office, left this week for Cleveland to attend the convention of Sunbeam lamp salesmen at Nela Park. Mr. Dee has been specializing for the past two months on the sale of the new Type C Mazda units for exterior lighting purposes among the merchants of Salt Lake City and has been highly successful.

F. J. Bell, manager Canada Wire & Cable Company, Toronto, Ont., was at Vancouver, B. C., during the past week in conference with **J. B. Sunderland**, electrical department of Macdonald Marpole Company, distributing agents for the company for British Columbia and the Yukon. While at Vancouver Mr. Bell made arrangements whereby Messrs. Chapman & Walker will be the selling agents for the company's rubber covered wire in this territory.

Thos. G. Grier, western manager of Harvey-Hubbell, and vice-president of the 1900 Dry Battery Company with headquarters at Chicago, stopped off at Salt Lake City last week on his return trip through the Yellowstone National Park. Mr. Grier is a pioneer electrical manufacturer's agent and recalls with pride the fact that he sold the entire electrical equipment for the celebrated Salt Lake Temple which was in course of erection for forty years, and completed in 1890.

A. W. Peard, sales manager of the Spencer Turbine Cleaner Company of Hartford Conn., is in Salt Lake City in connection with several important vacuum cleaner contracts which are to be let in the near future. His company works through the Capital Electric Company, and after completing his work here, Mr. Peard will visit the capital's various branch houses of the company in order to familiarize their branch salesmen with the merits of his company's products.

W. S. Turner, consulting engineer at Portland, Ore., has been appointed chairman of the Portland reception committee to entertain visitors passing through Portland, while visiting the Pacific Coast in connection with the International Electrical Congress to be held at San Francisco in 1915. The other members of the committee are: **O. B. Coldwell**, Portland, Railway, Light & Power Company; **H. M. Friendly**, Spalding Building; **F. W. Hild**, Portland Railway Light & Power Company; **Paul Lebanbaum**, Portland, Eugene & Western Railway Company; **L. Y. Kerwin**, Northwestern Electric Company; **R. F. Monges**, General Electric Company; **A. S. Moody**, General Electric Company; **W. D. Scott**, The Pacific Telephone & Telegraph Company; **H. R. Wakeman**, Portland Railway, Light & Power Company; **C. L. Wernicke**, Westinghouse Electric & Manufacturing Company; **F. D. Weber** Underwriters' Equitable Rating Bureau; **C. F. Nock**, The Pacific Telephone & Telegraph Company; **B. C. Condit**, Northwestern Electric Company, and **J. W. Martin**, Pacific Power & Light Company.

MEETING NOTICES.

Alameda County Electrical Development League.

The regular monthly meeting of the Alameda County Electric Development League was held on July 25th at the Saddle Rock cafe in Oakland. President Geo. Furniss presided, there being an attendance of over thirty members. The paper of the day on Indirect Lighting was presented by R. E. Smith of the National X-Ray Reflector Company.

The Southwestern Electrical & Gas Association.

At a meeting of the executive committee of the Southwestern Electrical & Gas Association, held at the office of the Association, 405-6 Slaughter Building, Dallas, Texas, July 18, 1914 it was unanimously decided that the next annual convention of the association would be held in Galveston, Texas, May 19, 20, 21 and 22, 1915, the Hotel Galvez to be convention headquarters. Further information with regard to this may be obtained from the secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Texas.

Salt Lake City Electrical Contractors.

"If you would know a man, eat breakfast with him," says the old adage. If it is not convenient to eat breakfast with him do the next best, eat luncheon with him, so believe the electrical contractors of Salt Lake City. In order to become better acquainted socially and consequently to promote a freer and closer business relationship, the electrical contractors of Salt Lake City for the past several months have been eating their luncheons together three times a week at the Commercial Club. They convene promptly at 12 o'clock and close promptly at 1:00. If matters affecting the electrical industry require attention, these are discussed, as for example: The commission of Salt Lake City is proposed to revise the present electric sign ordinance, and after discussion it was found that while in the main this sign ordinance was a decided improvement over the old one, that there were certain features which would work to the disadvantage of sign users, and consequently to the electrical industry. A committee was appointed, therefore, to wait on the city commission and explain the situation with the view of having the necessary remedy made.

Pacific Coast Convention A. I. E. E. and N. W. Electric Light & Power Association.

A joint parallel meeting of the sixth annual Pacific Coast convention of American Institute of Electrical Engineers and of the Northwest Electric Light and Power Association will be held at Spokane, Wash., September 9, 10 and 11, headquarters being established at the Hotel Davenport.

The A. I. E. E. program as arranged tentatively will be as follows:

September 9th.

Morning—Office open for registration. Joint opening meeting, with addresses of welcome followed by a separate session with paper and discussion.

Afternoon—Separate session with papers and discussion. Reception by the Ladies' Reception Committee to the visiting ladies at the Davenport Hotel with afternoon tea.

Evening—Joint Smoker with members of N. W. E. L. & P. Association with Dutch lunch. Theater party for visiting ladies.

September 10th.

Morning—Separate session with papers and discussion.

Afternoon—Joint session with N. W. E. L. & P. Association with papers and discussion. The papers for this session will be furnished by members of the N. W. E. L. & P. Association. An automobile trip around the city for the visiting ladies, ending at the Country Club where afternoon tea will be served.

Evening.—Joint meeting with an illustrated lecture by A. H. Halloran on the Electrical Features of the Panama-Pacific Exposition and a Presentation of the International Electrical Congress, followed by a musical entertainment

and buffet luncheon. This meeting will include the ladies as well as the men.

September 11th.

Morning—Separate session with papers and discussion.

Afternoon—Separate session with papers and discussion. Automobile trip for the ladies to Hayden Lake with afternoon tea served at Bozanta Tavern.

Evening—Joint banquet for men. Theater party for the visiting ladies.

September 12th.

Joint excursion by automobile to Little Falls and Long Lake, including ladies.

September 13th.

Joint trip over part of the Inland Empire Railway System to the Palouse country and Coeur d'Alene Lake, including ladies.

The proposed papers for the Northwest Electric Light & Power Association are as follows:

"Rates and Physical Valuation," by W. W. Cotton of the Portland Bar. "A Balance of Stores System for Light & Power Utilities," by Edward A. West, Portland Railway, Light & Power Company. "Out of Door Type of Transformer Stations," by J. C. Martin, Pacific Power & Light Company. "Rates: A Resume and Comparison of Rate Theories," by Stacey Hamilton, Portland Railway, Light & Power Company. "Extension of Electric Service Into Small Country Communities and Rural Districts," by M. C. Osborn, Washington Water Power Company and J. E. Davidson, Pacific Power & Light Company. "Wrinkles," by P. A. Bertrand, Grays Harbor Electric Company. "Electric Power Development on the Pacific Coast," by W. E. Herring, Puget Sound Traction, Light & Power Company. "Electric Appliances," by H. B. Peirce, The Washington Water Power Company. "Organization and Operation of Branch Offices and Plants," by Lewis A. McArthur, Pacific Power & Light Company. "Public Policy Review," by F. T. Post, The Washington Water Power Company.

The papers by Messrs. Cotton and Martin will be presented at the joint session.

The papers promised for the institute meeting are as follows:

"A Distribution System for Power Purposes," by F. D. Nines, Vancouver, B. C. "Electrical Application in the Lumber Industry," by E. F. Whitney, Portland, Ore. "Operation of the Butte, Anaconda & Pacific 2400 Volts D.C. Railway," by I. B. Cox and C. A. Lemmon, Schenectady, N. Y. "Considerations in the Application and Control of Electric Motors for Gold Dredges," by G. B. Rosenblatt, Salt Lake City, Utah. "The Effect of Delta and Star Connections upon Transformer Wave Forms," by Prof. Leslie F. Curtis, Seattle, Wash. "Economy in the Operation of 55,000 Volt Insulators," by Magnus T. Crawford, Seattle, Wash. "The Big Creek Development of the Pacific Light & Power Corporation," by Ed. Woodbury, Los Angeles, Cal. "A Report of the Work Done by the Joint Committee (California) on Inductive Interference With Telephone Lines," by A. H. Griswold, San Francisco, Cal.

"ROSTER OF THE JOVIAN ORDER."

Mr. E. C. Bennett, Mercury for the Jovian Order, has just issued the 1913 Roster, containing the names of the 12,282 members who had joined up to December, 1913. This interesting and valuable book contains the list of members arranged alphabetically, potentially, and geographically, and constitutes the best "Who's Who" in the electrical industry that has yet been published. The volume contains over seven hundred pages of condensed information of value to everyone in the electrical business. On account of the expense of issuing the book, a nominal charge of \$2.00 is made for this invaluable traveling companion.

ELECTRICAL CONTRACTORS' DEPARTMENT

CONTRACTORS' CONVENTION AT SACRAMENTO.

Arrangements have been practically completed for the fifth annual convention of the California Association of Electrical Contractors at Sacramento, August 4, 5, 6, 7 and 8. An attractive program has been prepared, fine speakers secured and a large attendance is anticipated. Among important matters which are to be discussed are the state license law, the segregation law, and more active work of the committee of jobbers and contractors.

At the open meeting on Friday, August 7th, papers will be read by John A. Britton of the Pacific Gas & Electric Company; W. W. Briggs, of the Great Western Power Company; Carl Heise, Westinghouse Electric & Manufacturing Company; and C. F. Butte, of the Contractors' Association. W. Bailey will talk on Electrical Contracting Accounting. H. V. Carter, president of the Pacific States Electric Company and A. E. Elliott, secretary of the 'jobbers' association, will speak, as will also C. A. Herrold, an architect of Sacramento, and T. R. Hunter, consulting engineer at San Francisco.

The program is as follows:

Tuesday, August 4, 1914.

9:00 a. m.—Executive Committee meeting; 2 p. m.—Executive Committee meeting.

Wednesday, August 5, 1914.

9 a. m.—Meeting for members only; 2 p. m.—Meeting for members only; 1:30 p. m.—Boat ride for ladies down the Sacramento River in privately owned cruisers; 8 p. m.—Reception and dance at Sacramento Hotel, during the evening a very interesting series of lantern slides of the Lake Spaulding Dam will be shown through the courtesy of Mr. G. C. Holberton, of the Pacific Gas & Electric Company.

Thursday, August 6, 1914.

9 a. m.—Meeting for members only; 1:45 p. m.—Auto ride for all, leaving the hotel going direct to Folsom passing the large gold dredgers of the Natomas Dredging Company, and showing Folsom Prison, thence to Orangeville Colony, where a basket of Superior California fruit will be presented to all, leaving Orangeville will go to Fair Oaks by way of the winding way and returning to Sacramento via the Auburn Boulevard; 8 p. m.—Moonlight boat ride and dance on the Sacramento River a light lunch will also be served.

Friday, August 7, 1914.

10:00 a. m.—Open meeting; the public is invited; 2:00 p. m.—Open meeting; the public is invited; 1:30 p. m.—The ladies will be entertained by a sight-seeing trip about the city in electric coupes; 7:30 p. m.—Annual dinner.

Saturday, August 8, 1914.

8:30 a. m.—Annual outing, boat leaves city wharf at the foot of M street, at 8:30 sharp, arriving at Smith's Mound at 10:30 a. m.; 10:30 a. m.—Bamboo rods will be distributed to all wishing to enter the fishing contest, that will last the entire day. Prizes will be given as follows: Lady catching the largest fish; lady catching the largest number of fish; gentleman catching the largest fish; gentleman catching the largest number of fish; W. C. Dolan in charge of arrangements, W. S. Hanbridge, J. W. Hooker, official judges; 11:00 a. m.—Ball game, Wm. Goodwin, manager; Southern California Contractors vs. Northern California Contractors; the contractors' cup is at stake on this game and prizes as follows: Player making the most runs, player making the greatest number of errors will be fined \$1.00, to be given to the player making the most runs; Charles Graham, umpire; 12:30 p. m.—Individual lunches will be served to all in the grove along the river bank; 1:00 p. m.—Volunteer pillow contest, C. V. Schneider in charge, Newton Graham, Carl Heilbron, judges; a valuable prize will be awarded to the winner of this contest; 1:30 p. m.

—Races. There will be three races for the ladies and the winner of each race will receive a prize; Carl Lamus in charge; Mrs. C. R. Gill, Mrs. S. B. Gregory, judges; 2 p. m.—Men's three-legged race, 100 yards; a prize has been arranged for the winning team; Carl Lamus in charge, Mr. Holabird, Chas. Hillis, judges.

2:15 p. m.—Men's sack race, 100 yards; three prizes. All entrants not finished will be awarded a box of fruit. L. A. Schloss in charge; Wm. Berry and Arthur Rowe, judges. 2:30 p. m.—Ball game; Wm. Goodwin, manager; Jobbers vs. Contractors. Awards same as morning game. The Jobbers' cup is also at stake on this game. 3 p. m.—Children's races; L. A. Schloss in charge. All children entering the races will receive a prize. 3:15 p. m.—Children's races; L. A. Schloss in charge. 4 p. m.—Closing of the big fishing contest and judging to take place in front of the grand stand; W. S. Hanbridge, J. W. Hooker and W. C. Dolan, judges. Music and dancing throughout the entire day. Music by a five-piece orchestra. 4:30 p. m.—Boat leaves for return trip to Sacramento. 8:00 p. m.—Jovian Rejuvenation at Elks' Hall under the direction of G. Stanley Pearce, Statesman. 8:30 p. m.—Ladies will be entertained at whist in the parlors of the Sacramento Hotel. Mrs. C. V. Schneider in charge. There will be three prizes for the ladies winning. There will be three gate prizes awarded at the picnic.

COMMITTEES.

Finance.

A. P. Peck

Printing.

W. C. Dolan

Publicity.

W. C. Dolan

Boat Ride for Ladies Down the River, August 5th.

Homer Moore	Mr. MacAvoy	Mrs. G. S. Pearce
Mr. Lewis	Harry Sayles	Mr. R. E. Fisher
	Miss E. Meyers	

Reception and Dance, August 5th.

L. A. Schloss	Arthur Rowe	D. W. Carmichael
C. W. McKillip	C. W. Wheeler	A. J. Brown
	Geo. C. Holberton	

Auto Trip to Folsom, August 6th.

C. R. Gill	S. B. Gregory
Carl Vining	Mr. Camp
Mr. Libbey	Mrs. Tom Scott
John Lidemeyer	

Moonlight Boat Ride and Dance, August 6th.

R. L. Douglas	Frank Fowden
C. W. Allen	Mrs. W. H. P. Hill
Carl Hoskinson	Mrs. C. W. McKillip
W. R. Dunbar	

Auto Trip for Ladies Only, August 7th.

Carl Lamus	Mrs. Ben Leonard
Mrs. Stanffer	Mrs. J. Grant Black

Annual Banquet, August 7th.

C. S. Pearce	H. E. Herr	Mrs. C. V. Schneider
H. E. Sanderson	C. D. Herbert	Mrs. Carl Lamus

Annual Ball, August 7th.

T. J. Dillon	Arthur Rowe
C. W. Hall	E. W. Beardsly
R. E. Griggsby	Mrs. Ross L. Douglass
Mr. Henkle	Mrs. J. C. Hobrecht
Newton Graham	Miss Louise Schneider
Harry Daly	

Annual Outing, August 8th.

J. C. Tobey	M. J. O'Connell	Mrs. C. R. Gill
J. H. Fagg	C. L. Gibson	Mrs. H. E. Herr
	Carl Beaton	

Prizes for Outing, August 8th.

A. P. Peck	A. E. Drendel
G. G. Doty	

Ladies Card Party, August 8th.

Mrs. C. V. Schneider	Mrs. Tom Scott
Mrs. C. R. Gill	Mrs. Dolan
Mrs. C. S. Pearce	Mrs. Ross L. Douglas
Mrs. J. Crombach	Mrs. T. J. Dillon
Mrs. Sloss	

Reception.

Tom Scott	C. B. Hall	L. A. Sloss
C. V. Schneider	Newton Graham	F. B. Hyde
W. B. Hall	Miles Steel	Geo. A. Gray
C. W. McKillip	S. A. Baker	A. J. Coffee
C. C. Davis	H. E. Squires	W. H. P. Hill
C. E. Wiggins	Bert Hanson	L. S. Somers
H. F. Schultz	J. H. Murray	Chas. Graham

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Oakland, Antioch & Eastern Railway has filed an application with the commission asking authority to issue \$900,000 of 6 per cent convertible gold notes to be secured by its first mortgage 30 year gold bonds in ratio of 2 to 1. The notes are to be convertible before maturity at the holder's option on the basis of 80 per cent of the par value of the bonds and accrued interest as against the par value of the notes and accrued interest. It is furthermore, provided that the notes shall be redeemable in whole or in part at the option of the company on any interest date at face value and accrued interest on not less than 30 days' notice. The company proposes to sell these notes at not less than 96, the proceeds to be used toward paying off floating indebtedness. The company now has outstanding 100,000 shares of common stock, par value \$100, and 4355 First Mortgage 30 year gold bonds par value \$1000. During the last fiscal year it paid out \$280,736.15 in interest.

The Los Angeles & San Diego Beach Railway Company, operating in San Diego, has filed an application with the commission asking authority to issue \$825,000 of bonds. These bonds will be secured by a trust deed of all the company's property and are to be used in electrizing certain portions of the railway company's lines, as previously ordered by the commission, and in improving those now in existence.

The commission has rendered a decision authorizing the Southern Counties Gas Company of California to issue 3 year 6 per cent promissory notes of the face value of \$240,500. The commission's order provides that these notes shall be issued so as to net not less than 93 per cent of the face value.

The Roseville Telephone Company, operating at Roseville, Placer county, has filed an application with the commission asking authority to issue 50 shares of capital stock of the par value of \$10 per share. The company represents that the sale of this stock is necessary to furnish funds to pay for labor and material used for construction since April 1, 1914.

The commission has rendered a decision authorizing the Oro Electric Corporation to renew promissory notes totaling \$71,960.23. The money derived from the sale of these notes was expended for the purchase of materials used in the construction of the corporation's system.

The adjourned hearing in the commission's inquiry into the financial condition of the United Railroads of San Francisco, which was set for July 28th, has been postponed until August 14th at 10 a.m. The postponement was made at the request of the company, which asked for further time in which to prepare its figures.

NEWS OF ARIZONA CORPORATION COMMISSION.

The Tucson Gas, Electric Light & Power Company has been authorized to defer for a period of one year the setting aside as depreciation reserve any portion of the earnings or other moneys. The company has also been directed to amortize in equal monthly payments for a period of 120 months, all proper expenses, allowed and approved by the commission, in the matter of I. E. Huffman et al., complainants, vs. Tucson Gas, Electric Light & Power Company.

The Globe & Miami Traction Company has been given permission to sell 7500 shares of its capital stock, for not less than 90 per cent of its par value of \$10 per share, and the proceeds shall be applied solely in building an interurban car line between the towns of Globe and Miami, in Gila county, Arizona, a distance of approximately 6.7 miles, authorization having also been given to exercise its franchise.

The Tucson Gas, Electric Light & Power Company has been authorized to advance the Tucson Rapid Transit Company \$40,000 for the purpose of making certain improvements, betterments and extensions to its street railway system in the city of Tucson.

The Nebo Electric Light & Power Company has been granted a certificate of convenience and necessity to construct, maintain and operate an electric light and power plant in the town of St. Johns, Arizona, contingent upon prompt construction of the project and completion within a reasonable time.

The commission's General Order No. 37 provides that all telephone, telegraph, signal, trolley, electric light and power lines, now or hereafter constructed within Arizona, shall be constructed and maintained in conformity with the specifications contained in the Report of the Committee on Overhead Line Construction of the National Electric Light Association. Provided, also, that the same general regulations shall apply to all direct current overhead trolley construction and reconstruction of whatever nature within the state. And, further provided, that all lines of aerial wires, or cables, of telegraph, telephone, signal and all other electric wires of similar nature, now or hereafter to be constructed across steam railroad rights of way, tracks, or lines of wire of the same classes, shall be constructed and maintained in conformity with the specifications applying to such classes of wires, cables, or lines, prepared by a joint committee and adopted by the Association of Railway Telegraph Superintendents, in convention at St. Louis, Missouri, May 20, 1913. Modifications and additions to said specifications, made by said N. E. L. A., upon approval first having been made by this commission, shall be in full force and effect with relation to overhead line construction in this state. All telephone, telegraph, signal, trolley, electric light and power lines, now constructed in Arizona shall conform to those specifications, applying thereto, within a period of five years from the date of this order.

TRADE NOTES.

The Great Western Power Company has moved its San Francisco offices from 233 Post street, to 14 Sansome street.

The United Light & Power Company, San Francisco, has removed its offices from the Mechanics' Institute Building, to 511 Sutter street, Press Club Building.

It will perhaps be a matter of interest for engineers to know that since the editorial on "Electric Plowing" appeared in the Journal of July 25th our attention has been called to the design of an electric tractor which meets all the specifications cited.

The Humphrey Gas Engine Pump Company of Syracuse, N. Y., is preparing an exceptionally handsome exhibit for the Panama-Pacific International Exposition which will be of great educational value. It will be located in an advantageous position in the Palace of Machinery and will display in operation some of the latest types of pumping machinery.

The B. C. Steel Works, Ltd., will shortly be established near Bridgeport, Lulu Island, on a site of 5 acres with 300 ft. water frontage. The company is capitalized at \$500,000 and will require buildings and machinery to cost \$100,000. The works will manufacture merchant bar, angle iron, rounds, flats, bolts, nuts and light rails from scrap which will include wrought iron, steel scraps, turnings, pipe plates, shearings, etc. Francis L. Leighton, manager of the Vancouver Engineering Works, is one of the directors.

The board of education at Salt Lake City has awarded to the Inter-Mountain Electric Company the contract for the electrical cooking equipment for the cafeteria for the new East Side High School which is nearing completion and will be placed in service at the beginning of the next school year. The equipment will consist of two No. 14 Simplex Ranges, one of them to have 2-15 in. discs, and the other to have 1-10 in. disc, 1-12 in. disc, 2-8 in. discs, and 2-6 in. discs, with a complete line of lock-on cooking utensils to fit the various discs. In order to accommodate the large amount of baking necessary an additional baking oven will be furnished. Also a 3 gallon chocolate urn and a 6 ft. electrically heated steam

table, all made by the Simplex Electric Heating Company of Cambridge, Mass. The equipment is intended to be adequate to serve 800 pupils with luncheon.

The Weyerhaeuser Lumber Company of Everett, Washington, has awarded the contract for the power plant generating apparatus, for its new saw mill to Allis-Chalmers Manufacturing Company. The equipment will include one 2000 kw. at 80 per cent power factor horizontal Allis-Chalmers Parsons steam turbine unit of the high pressure condensing type, also one 1000 kw. unit of the same characteristics, both units to be capable of a continuous 25 per cent overload. A 35 kw. impulse turbo-generator unit and a 35 kw. slow speed motor generator set will take care of the lighting and excitation. Both of the main units will be of the latest design of the manufacturers. The generators will be of the enclosed type, the cooling air being taken in and discharged to the basement. The current will be three-phase, sixty cycles at 600 volts. Motors will be used to drive the machinery for the saw, cedar, shingle and planing mills. The order was placed through the Seattle office of Allis-Chalmers Manufacturing Company. This is a noteworthy installation as when completed it will be the largest electrically operated sawmill in the world; the second largest being the Atlantic Coast Lumber Company's mill which is driven by three 700 kw. Allis-Chalmers steam turbine units. The Weyerhaeuser mill is being designed by Mr. A. B. Pracna, consulting engineer, of Seattle, Washington.

In the recent Vancouver, B. C., pageant, the Ross & Howard Iron Works Company, Ltd., float consisted of a section of the penstock made by the company for the Western Canada Power Company. This is said to be the largest in Canada. It weighs 187,751 lb. This pageant, the first of its kind, was held in honor of the convention of the Pacific Coast Advertising Men's Association and the B. C. Lumbermen's concatenation. The B. C. Electric Railway Company's floats were of especial interest, one consisting of the oldest car used in 1889, when the rolling stock of the company consisted of two cars and manned by the crew of longest service, a comparison being made with the present splendid equipment of 231 cars. The other float was appropriately labelled, "The Source and the Service" and consisted of a working model of No. 2 Power House situated at Lake Buntzen on the North Arm of Burrard Inlet. The float was mounted on an electric truck, the current from the storage battery being used to operate a small motor which pumped water from storage tanks through the tail races of the power house during the course of the parade. At each corner of the float were towers each occupied by employees and equipment representing the utilization of energy and the service rendered. The Vancouver Gas Company entered two floats representing the old and the new way of lighting and cooking, also the use of gas for industrial purposes.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., announces that it has supplied the following apparatus to metal mines during May, 1914: August Mining Company, Landusky, Mont.: Three 75 k.v.a., 11,000 volt, type SK transformers; one electrolytic lightning arrester; one complete switchboard equipment; one 125 h.p. belted motor for tube mill drive; one 35 h.p. motor for driving rolls; one 25 h.p. motor for driving crusher; one 15 h.p. motor for driving belt conveyor; one 10 h.p. motor for driving air compressor for agitator, two 7½ h.p. motors for driving triplex plunger pumps; one 3 h.p. motor for driving placer firer; four 7½ h.p. slow speed motors for driving slime pumps; complete line material for 23,000 volt high tension line; two 4 k.v.a. type S lighting transformers. Anaconda Copper Mining Company, Boston & Montana Reduction Department, Great Falls, Mont. Four 30 h.p. motors with PB brakes. These motors are to control 8 ft. gate valves in the air line supplying blast to the copper furnaces. Anaconda Copper Mining Company, Butte, Mont.: Three 3½ ton, 18 in.

gauge, 250 volt bar steel locomotives with 901-B equipment. The above are to be exact duplicates of locomotives previously furnished this customer, making approximately the fifth repeat order for this class of machine. International Smelting & Refining Company, Miami, Ariz.: Seven 50 h.p. back geared a.c. mill motors with magnetic brakes for operating 12 ft. Great Falls type converters; two 150 h.p. motors for belt driving rolls and crushers; two 25 h.p. back geared d.c. mill motors for Matte casting machines; ten d.c. mill motors with brakes and magnetic control. All of the above apparatus for a new copper smelter. Anaconda Copper Mining Company, Butte, Mont.: Four 7½ h.p. motors for fans; one 25 h.p. motor with double extended shaft for pump; three 5 h.p. motors; one 10 h.p. motor; one 50 h.p. motor; one 100 h.p. motor. The above for use in a new leaching plant being built at the Washoe Smelter. International Smelting & Refining Company, Tooele, Utah: Two 10 h.p. motors; two 3 h.p. adjustable speed totally enclosed back geared commutating pole d.c. motors with drum controllers; two 5 h.p. motors; one 75 h.p. motor. The above for a sintering plant in an old smelter. International Smelting & Refining Company, Tooele, Utah: One motor generator set, switchboard and regulating devices for Cottrell fume deposition process. Ray Consolidated Copper Company, Hayden, Ariz.: Sixteen 10 h.p. special vertical slow speed motors. The above for driving agitators in an installation using the oil flotation process. Utah Copper Company, Magna, Utah: Seven 10 h.p. special vertical slow speed motors. The above for driving agitators in an installation using oil flotation process. Daly West Mining Company, Park City, Utah: One 300 h.p. 2200 volt hoist motor with liquid controller and complete switchboard equipment. Alaska Gastineau Mining Company, Juneau, Alaska: One 6 ton storage battery locomotive, one 50 kw. motor generator set. Empire Mines & Investment Company, Grass Valley, Cal.: One 500 h.p. motor; one liquid controller for the above; three 200 k.v.a. 4000 volt, O. I. S. C. transformers; one 3-phase induction regulator, 45 kw.; six 35 h.p. special back geared stamp mill motors. The above 500 h.p. motor is for double drum hoist. The control equipment furnished will include all switchboard apparatus and a number of special safety devices. Calumet & Arizona Mining Company, Bisbee, Arizona: Two 300 k.v.a. 3-phase O. I. S. C. transformers and switchboard equipment.

NEW CATALOGUES.

Westinghouse, Church, Kerr & Company of New York have issued No. 6, "Work Done," illustrating many examples of their industrial plant construction.

"Small Motors," No. 20, from the industrial and power department of the Westinghouse Electric & Manufacturing Company, is devoted to the field for the sale of electric ventilating outfits.

The Harris Valveless Engine, Diesel principle, is illustrated and described as to construction, operation and application in a series of pamphlets bound in a handsome folder from the Harris Patents Company, 328 Chestnut street, Philadelphia.

Busch-Sulzer Bros. Diesel Engine Company of St. Louis are distributing an attractive folder from their San Francisco offices in the Rialto Building, entitled "Evidence" and containing a series of users' statements regarding the merits of the Diesel engine.

Mercury Type Direct Current Watthour Meters are attractively portrayed in Bulletin No. 37, a handsome brochure, from the Sangamo Electric Company of Springfield, Ill. Every detail of construction is as well shown as it is possible for clear text, fine pictures and good press work to bring out. This is one of the most beautiful and valuable meter catalogues ever published.



INDUSTRIAL



MATHIAS KLEIN & SONS' NEW PLANT.

In order to meet the constantly increasing demand for their high grade linemen's tools, Mathias Klein & Sons recently moved into their new and larger factory at Avondale on the northwest side of Chicago. The main offices and salesrooms are still at 562 W. Van Buren street, Chicago. The location which this firm has occupied since 1881, when it constituted the entire establishment.

The new factory is built in three sections, the main three-story factory, 55x278 ft., the forge building, 60x233 ft., and the power plant, 60x100 ft. All the buildings are of brick, mill construction and automatic sprinklers giving a low insurance rate.

Particular attention has been paid to the comfort and convenience of employees. Good light and good ventilation make for congenial surroundings and efficient work. As the buildings do not yet occupy all the six acre plat which the company owns, it has been parked to provide a noon-time recreation and resting place.

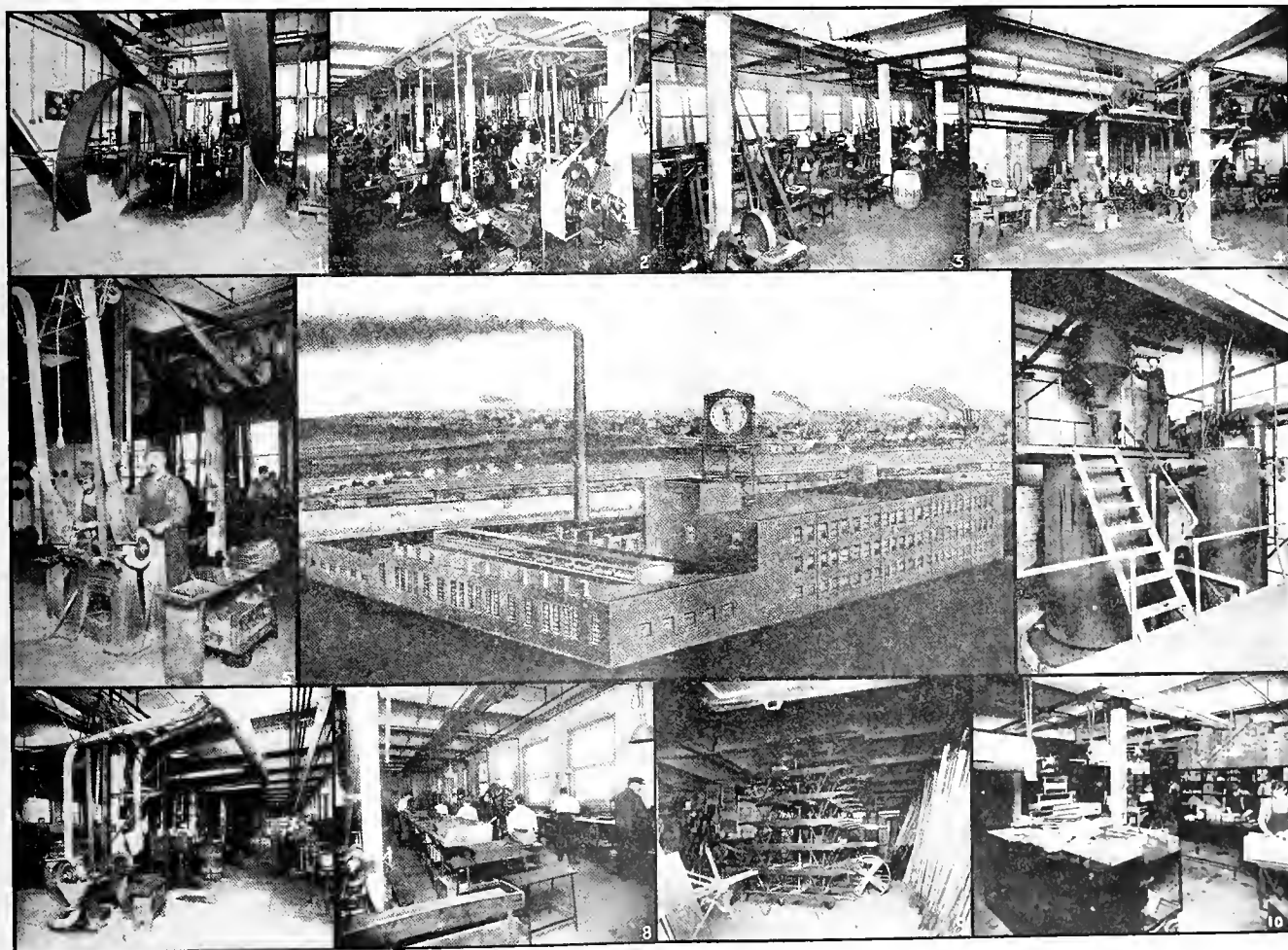
The power house is equipped with a 100 kw. Western Electric three-wire generator driven by a 125 h.p. Murray Corliss engine to supply light and power. It also houses the central heating plant and the Flinn-Dreffein gas pro-

ducer which furnishes 1300 to 1400 cu. ft. of gas hourly for the use of the forging and tempering furnaces. The Corliss engine also operates two lines of shafting in the forge building.

In the process of manufacturing pliers and other tools the blanks are first heated in gas furnaces and then forged into shape with power hammers. The rough tools are then taken by elevator to the milling and drilling department on the second floor, whence they are taken to the assembly department on the third floor where they are sorted and assembled. After being ground to proper sizes by emery wheels, they are heated in gas furnaces for oil-tempering. After careful inspection the tools finally pass to the shipping room on the ground floor when they are placed in standard packages ready for the stock room or outgoing consignment.

In addition to the present production of 3700 pliers a week, this company also manufactures polemen's climbers, wire-reels, pole construction tools, etc.

Mathias Klein founded this business in 1857 and, though now 88 years of age, still takes an active interest, ably seconded by his sons and grandsons. The business has grown and prospered on the policy of always furnishing better tools than specified.



New Plant of Mathias Klein & Sons, at Chicago.

No. 1, Engine Room. No. 2, Milling and Drilling Department. No. 3, Plier Assembling Department. No. 4, Plier Finishing, Tempering and Inspecting Department. No. 5, Grinding Room. No. 6, Gas Producer Plant. No. 7, Climber Finishing Department. No. 8, Plier Converter Assembly Department. No. 9, Constructive Tool Stockroom. No. 10, Packing and Shipping Department.



NEWS NOTES



INCORPORATIONS.

SANTA ANA, CAL.—Pacific Light & Power Company, \$40,000,000, subscribed \$7000, by W. T. Kerckhoff, H. E. Huntington, K. Kohn, G. S. Patton, C. Forman et al.

NILAND, CAL.—The Niland-Blythe Railroad Association has been formed by Arthur E. Hull, representing the Niland chamber of commerce and G. Ghiglieri, J. S. Diller and P. A. Raab, president of the Los Angeles Creamery Company, representing the Palo Verde district, to build an electric railway between Niland and Blythe.

WATERWORKS.

BOVILL, IDAHO.—At the recent election a bond issue for a new waterworks system to the amount of \$12,000 carried.

NEHALEM, ORE.—This city has voted to issue bonds in the sum of \$12,500 for the purchase of the present water plant.

SAN DIEGO, CAL.—The City Council has asked Ed Fletcher and James H. Murray, owners of the Cuyamaca lake and water system, to set a price on the whole system, either to purchase or lease.

BILLINGS, MONT.—Dillon, Thompson & Clary of New York have indorsed the legality of the city's \$450,000 bond issue for the purchase and improvement of the water system. The bonds will be sold August 15.

LOS ANGELES, CAL.—The City Council has approved the action of the water board in purchasing for \$19,000 a portion of the Glendale Consolidated Water Company inside the city. The system is located in North Highland Park and Hermon.

LOS ANGELES, CAL.—By a plurality of 79 over necessary two-thirds vote, voters of Glendale carried the \$248,000 water bond. The bonds will be issued to purchase all water systems in the city, which will be combined into a municipal system.

PORTLAND, ORE.—The water bureau will attempt to increase the water service in the Peninsula district by enlarging the system, at a cost of about \$113,000. This amount will include the extension of the present 30-inch main, supplying the northeast section of the city, for a distance of nearly 2½ miles.

LOS ANGELES, CAL.—By unanimous vote on application of property owners in the vicinity of Torrence, the Board of Supervisors gave authority for the formation of the Lomita water district, to be used solely in the development of water for domestic uses. L. M. Pollock, J. E. Chandler and M. B. Smith have been appointed directors of the district.

POCATELLO, IDAHO.—The City Council has called a special bond election for August 25, for the purpose of voting on an issue in the amount of \$400,000 for acquiring a municipal water system for the city either by purchase of the present water plant from James A. Murray, and bringing it to the requirements of the city, or installing a complete new plant.

RICHMOND, CAL.—At a special election the past week a proposed issue of \$2,500,000 in bonds to provide for water for a district composed of Richmond, Stege, Rust, San Pablo and Grant, was defeated. The vote was 1616 in favor of the project and 921 against. It was proposed to bring the water from the Sacramento River at Toland's Landing, 47 miles from Richmond.

OAKLAND, CAL.—F. C. Havens has resigned as president of the People's Water Company and has been succeeded by J. Y. Eccleston. Havens and C. H. Redington retire from the board of directors, and Eccleston, E. A. Heron and John

S. Drum become directors. Drum is the president of the Savings Union Bank and Trust Company of San Francisco and was one of the committee which recently reported on the company's finances. The new board of directors consists of Eccleston, Drum, Heron, Arthur G. Tasheira, H. C. Capwell, George N. O'Brien and Frank A. Leach. Havens' letter of resignation explains the reasons for the change. It reads: 'In view of the earnest efforts now being made by various committees representing the bondholders, noteholders and others interested in the financial affairs of the People's Water Company, and wishing to avoid even the slightest suspicion of retaining any official position in the directorate of the company that might be supposed to give me any personal or undue advantage over any other person or persons so interested, I desire to and hereby do tender my resignation as a member of the board of directors of the People's Water Company, and also as president of the company, and urgently request that such resignation be accepted forthwith. Voluntarily and unreservedly I desire to take my place among all others financially interested in a readjustment of the financial affairs of the company, claiming over none superior rights or advantages for myself.' The voting control of the company has been placed with the Mercantile Trust Company by Havens. This voting control remains operative until January 1, 1915. Another change in the affairs of the company was made at the meeting of the directors, when W. R. Alberger was elected general manager. Alberger was recently vice-president and general manager of the Key Route and Oakland Traction properties. The noteholders' committee and the committee representing the bondholders of the People's Water Company met in joint session recently. Up to date the owners of \$787,000 of the notes of the company have signed the agreement that has been proposed.

ILLUMINATION.

EMMETT, IDAHO.—An ordinance has passed the council granting to the Beaver River Power Company, an extension of six months' time on its franchise.

SAN MATEO, CAL.—R. C. Smoot, president of the Merchant's Association, has informed the board that the committee has decided that 58 electroliers will be needed in the proposed city system.

LOS ANGELES, CAL.—The board of county supervisors is now arranging preliminary plans for a lighting project by which all of the boulevards now being made in Orange county will be lighted.

PORTLAND, ORE.—A building permit has been issued to the Portland Gas & Coke Company to erect a steel and concrete gas holder. The structure will be built underground at the head of Clinton street at E 11th.

KENT, WASH.—The council has considered the application of Alfred Giffler of Seattle who offers to have a plant in operation within one year. The matter was left with the lighting committee and the city attorney.

SAN FRANCISCO, CAL.—Master in Chancery H. M. Wright has rendered a supplemental report to the U. S. District Court in the suit instituted by the Pacific Gas & Electric Company to enjoin the city from fixing a 75c gas rate for the year 1913-1914, in which he finds that this rate is practically confiscatory. At a recent hearing it was discovered that a mistake aggregating nearly \$95,000 had been made in the figures first submitted. Wright says he found that he should have computed the return on the basis of a net income of \$627,577 instead of \$722,468. On the basis of the revised net income, Wright says the company was getting only 5.21 per cent on its investment, instead of 6 per cent, to

which, he declared, it is entitled. U. S. District Judge Van Fleet has raised the bond of the gas company from \$50,000 to \$300,000, following the report that the company now has \$260,000 of impounded money on hand, waiting for a decision of its injunction.

TRANSMISSION.

KALAMA, WASH.—The machinery in the new power plant of the Oregon-Washington corporation on the Kalama River was badly wrecked when a large turbine got beyond control. Two of the fly wheels exploded, tearing out one entire side of the building and doing other damage.

SALMON CITY, IDAHO.—Plans are being considered for the installation of a new power plant on the Salmon River. The Gilmore mines will use a great deal of the power to be generated by this new plant which will also furnish power to a large gold dredge to be built and operated on Geertson Creek.

SPOKANE, WASH.—The Public Ownership League has called a meeting to be held at the office of J. M. Simpson this week to discuss the Pacific Telephone & Telegraph franchise. R. B. Martin, secretary of the league, states that the question of a municipal light and power plant will next engage the efforts of the league.

LOS BANOS, CAL.—A survey is being made by the San Joaquin Light & Power Corporation for the running of an additional power line from this city to the Oro Loma country. It will take 30 days to complete the 16 miles of new line. The present line is being taxed to its capacity by the pumping plant motors on the Oro Loma and the new service will be of an increased capacity.

SHOSHONE, IDAHO.—An ordinance providing for incurring an indebtedness in the sum of \$18,000 and for the issuance of municipal bonds in that amount for the purpose of purchasing waterworks and franchises of the Great Shoshone & Twin Falls Water Power Company and for extending and enlarging the system has been passed. The bonds will be 20 year bonds, redeemable 10 years from date.

SALT LAKE CITY, UTAH.—Word received here by officials of the Utah Power & Light Company indicates the early completion of the work of rebuilding the transmission pole line running from Park City through the Wasatch Mountains into the Salt Lake Valley via the company's power plants on Mill Creek in Mill Creek canyon, southeast of Salt Lake. The transmission line extends from Park City to Eureka, Utah.

NORTH YAKIMA, WASH.—H. B. Scudder, president of the Yakima Central Heating Company, is reported to have said that the recent public service commission hearing for the purpose of fixing rates of the Pacific Power & Light Company, will be of great value for the purposes of comparison with the cost of producing electrical energy by steam in the district where his company expects to carry on an additional campaign in order to secure a franchise.

QUINCY, CAL.—The supervisors have reconsidered their order to the District Attorney to obtain an injunction against the Great Western Power Company, preventing it flooding the county roads at its dam and reservoir at Nevis. The company does not intend to raise its dam at this time. The county surveyor is instructed to view the new roads built for the county by the company in lieu of the old flooded roads, to see whether the county should accept them.

TUCSON, ARIZ.—Through the issuance of 6 per cent notes the Federal Light and Power Company has secured a loan of \$170,000. This sum will be expended on improvements needed by the Tucson Rapid Transit Company and the Tucson Gas, Electric Light & Power Company, subsidiary concerns. The amount has been divided as follows: Power house extensions, \$100,000; for street railway improvements, \$40,000; gas plant, \$10,000; extension of transmission lines for irrigation pumping, \$20,000.

OROVILLE, WASH.—Negotiations were completed last week whereby the Similkameen Power Company transfers to the Okanagan Valley Electric Power Company all title and interest in the present electric power site and plant at the Similkameen Falls. It is stated that while the plant itself is of no great value, the power site is one of the best in the state and can be developed at comparatively little expense. The newly organized company is backed by eastern capital. It is further reported that an additional 2000 h.p. will be developed at once.

DENVER, COLO.—The western slope from Durango north to Grand Junction is to be gridironed with hydroelectric power lines for the development of that section of the state as a result of a consolidation of a number of Colorado companies according to information given out by semi-official sources. The Western Colorado Power Company, the Colorado division of the Utah Power & Light Company, has taken over in fee simple the plants of the Ouray Electric Light & Power Company, the Montrose Electric Light & Power Company and the companies operating at Ridgway and Delta. These are to be connected with the plants formerly belonging to the Telluride Power Company, the San Juan Water & Power Company, the Durango Gas & Electric Company, and the Telluride Electric Light Company, all of which are owned by the Western Colorado Power Company.

TRANSPORTATION.

LOS ANGELES, CAL.—The Pacific Electric Railway Company's substation located at Watts was almost completely destroyed by fire, causing a loss of about \$15,000.

SEATTLE, WASH.—Councilman O. T. Erickson has introduced an ordinance which specifies and adopts plans for an extension of the municipal car line into Ballard.

SEATTLE, WASH.—The council last week passed an ordinance providing for a new car barn and necessary tracks and switches for the Lake Burien line to be installed at a cost of \$3311.

EUGENE, ORE.—That the Portland, Eugene & Eastern Railway Company may begin the electrification of that portion of the west side system south of Whitson about the first of August is the rumor here.

TWIN FALLS, IDAHO.—H. A. Stroud and others are promoting the proposition of building the electric line of the Idaho-Pacific Electric Line, known as the Hagerman line. It is intended to raise \$100,000 in this city to start the proposition. E. S. Price, of Tacoma, Wash., is handling the sale of the bond issue.

SAN JOSE, CAL.—F. E. Chapin, vice-president and general manager of the Peninsular Railway Company, has announced that the present electric line out Alum Rock avenue will be converted into a broad gauge road as far as the King Road, by the end of the month, and he adds he is confident that the standard gauge will be continued on from that point to Kirk avenue by the coming January.

SEATTLE, WASH.—The first steps toward the extension of the municipal railway system into the Ballard district were taken last week with the introduction of an ordinance for the creation of this new division, which it is proposed shall start at the northern end of Division A at Third avenue West and Nickerson, and proceed to the proposed canal bridge at Fifteenth avenue, thence northwest to Ballard. The ordinance was referred to the city utilities committee.

TELEPHONE AND TELEGRAPH.

SAN JOSE, CAL.—A private telephone exchange for the use of the fire department was proposed at the meeting of the police and fire commissioners and the chief was authorized to arrange for the installing of the system.

LOS ANGELES, CAL.—The board of public utilities has recommended the granting of an application from the Home Telephone Company of San Pedro for a franchise to construct and maintain a telephone system in Wilmington.

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50-52 East Broadway, Butte; Van Nuys Bldg., Los
Angeles; Couch Bldg., Portland; 212 So. W. Temple,
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CO-OPERATIVE RATE MAKING SCHEDULES

BY WM. VAN DEN HEUVEL.

(After a discussion of the several factors governing rate making and a criticism of the sliding scale, maximum demand, flat rate and readiness to serve schedules, a proposed co-operative rate schedule is analyzed by the author, who is a consulting engineer at Los Angeles.—The Editor.)

It is the purpose of this article to analyze in a general way the present methods of rate making, to inquire into the correctness of various rate schedules now in use, and to endeavor to show that present schedules or charging methods do not stimulate proper

While from a legal or academic point of view it may be correct to term the relationship that of an agency or perhaps of a partnership, it appears in actual practice that such a relation is largely fictitious, surrounded by commercial conditions such as competi-

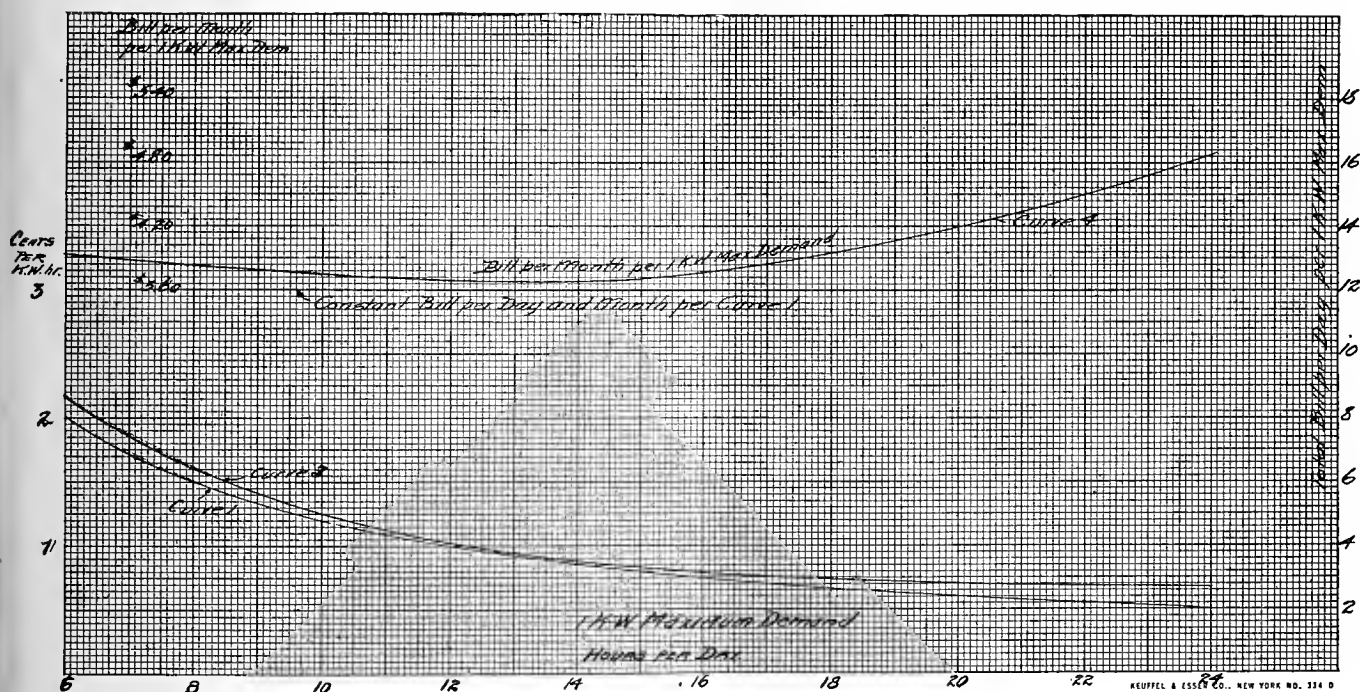


Fig. 1. Co-Operative Schedule for Irrigation Service.

use of electric power, especially in undeveloped territory.

The ever present desire of the consumer to obtain electric power at a low price, demands that the consumer do his share in making this possible, and it is my object to advance arguments and facts in favor of a co-operative element to be introduced into the relation between the public utility and the consumer. As a matter of fact this element is now totally absent, and in order to have a real co-operative relation, and not one merely in name, it should become evident in the business that arises between the public and the company, as far as charging methods are concerned.

tion from other forms of power, and with public utility service requiring the sale of electric power as a commercial proposition.

A co-operative relation between the public utility and the consumer should allow of just discrimination in the rate charged, in terms of the conditions that have bearing upon the nature of the service. When, however for the sake of simplicity the law of averages is applied in the construction of a schedule, care should be taken that a too liberal and inconsistent use of this law be avoided as being an unjust discrimination against certain classes of consumers. The classification of various consumers should be simple

enough to allow of speedy accounting and simple rate making, but the sacrifice of fairness for the sake of simplicity should be reduced to a minimum.

On account of the complexity of the problems of rate making, I shall limit considerations here to rate making for commercial power and especially to power for irrigation purposes. We are, in this use of power, confronted with one of the vital problems of development of this Western territory. In providing this service, and, especially in acquiring the business, the power company is confronted daily with the competition of steam and gas-engine power, and in many localities the total pumping business is fairly well divided between the various forms of power.

As a matter of pure economics, it is preposterous that in small plants the steam or gas engine can compete with electric power furnished by a power company. Yet, we know this to be the case and it remains to analyze this condition of affairs. The farmer when ready to put in a pumping plant, listens in turn to various salesmen and to solicitors of the power companies. However, only superficial study is made of the exact nature of his conditions. In almost every instance the proposition is one of obtaining a cheap plant that will produce water at a cost somewhere within reason. Investigation of the conditions is limited by the cost of such work, and even when the purchaser does see the advantages that might result from a careful study, the engineer whom he employs to look into the matter soon finds that purchased electric power is under decided limitations and that the schedule does not recognize the method of operation of the plant.

It is not reasonable to expect a low rate for power unless the conditions of use warrant it. The exercise of an intelligent judgment in the selection of pumping equipment, its size and the duration of the periods of operation, are all matters that are concerned with the rate that should apply, and the rate schedule should reflect influence of the method of use upon the price paid for power.

The problem of devising such rate schedules in equity to all concerned, requires a broader conception on the part of the power company of the scope of its business. While in the past we have had evidence, in some cases, of the willingness on the part of the power company to give thought to irrigation problems and to offer to the farmers rates that suit their business, these rates do not contain proper inducement to cause the farmer to adopt more economical irrigation methods. The organization of the power companies is such that it could easily permit of a department that would study irrigation from a broader viewpoint, and that would ascertain the best methods of use in various districts for the purpose of giving cheaper power produced at a lower cost.

Efforts in this direction will engage the co-operation of the farmer as a matter of course, and will create a relationship between the public utility and the public now absolutely unknown.

For the purpose of more clearly bringing out the advantages of co-operative schedules, a short discussion of existing schedules is desirable.

Sliding Scale Schedule.

The so-called cumulative sliding scale schedule as used in this part of the country, does not contain ma-

terial recognition of some factors that enter into the use of the service rendered.

It represents a successful attempt on the part of the power companies to provide a means for finding charges that must be billed to the customers, with due compensation for conducting its business as a whole. The simplicity of this schedule is commendable, but it has been obtained at the sacrifice of fairness in individual cases, when taking into account the conditions as they exist on the premises of certain consumers. It is not intended to convey by this statement that the rate charged is unfair, but rather that the schedule is not adapted for its purpose, namely, of giving a means of fairly charging a number of consumers of a certain description or class. If we, by the application of the law of averages, make the efficient user, under this schedule pay for the extra cost involved in serving the inefficient user we are making an unfair discrimination.

The sliding scale schedule stimulates primarily the installation of large plants, or rather the concentration under the same ownership of large horsepower capacity in motors. It does this regardless of the method of use, and limited only by the usual minimum charge per h.p. per month. It is not logical that the mere combination of the loads due to a number of motors in close proximity of each other should command a materially lower rate than the individual consumers aggregating the same load, merely on account of the omission of metering and collection charges. Yet this schedule uses such discrimination.

Though the statement may seem exaggerated, it is a fact that the sliding scale schedule, while favoring large motor installations, discourages by absence of sufficient compensation by way of a lower rate, systematic and efficient use on the part of the consumer.

In other words, it is often cheaper for the consumer to put in more motors, and operate them at times and in a manner suiting his own convenience, rather than to contemplate the further use of existing motors, perhaps at specified times and over longer periods. It is again only the minimum charge that limits him in adding additional motor capacity.

Maximum Demand Schedules.

The so-called maximum demand schedule, often also called load-factor, schedule, takes into account the consumption of energy per month per 1 kw. maximum demand on the premises of the consumer.

The schedule recognizes to some extent, economical use of the power by charges that grow less with increased use per 1 kw. maximum demand per month.

It is this use of the month as the controlling period in the establishment of the load factor, and of the charges applicable under the schedule, that is not in accordance with the natural cycle of use by most consumers. We note, for instance, that it is immaterial under such schedule whether 1 kw. maximum demand is used for 30 days per month and 12 hours per day, or for 15 days per month and 24 hours per day. The consumption per 1 kw. maximum demand is in each case 360 kw. hours, though it is evident that there is a considerable difference, both as to the cost of providing the service, and as to the value of same to the consumer.

Flat Charges.

Some of the power companies who have recently attempted to introduce new charging methods for some of their irrigation business, offer a flat rate per h.p. per year as best fitted to irrigation service. The rate thus offered charges the consumer \$50 per year for each 1 h.p. maximum demand as measured in the output of the motor. It is the intention to promote, by this rate, all year around use of the power and on a uniform basis and it compels the farmer to install a reservoir and to resort to night pumping in order to get down to a low rate.

No doubt this method of charging is preferable to any of the previous methods, but in my opinion, does not do justice to the facts. The method works an unnecessary hardship on the district as a whole, and requires the installation of a reservoir capacity larger than would be the result of joint operation of the district by all farmers combined. In other words, the flat rate schedule causes the farmer to go farther in producing uniform use on his own premises in order to obtain cheap water, than would be necessary in a co-operative sense, with the power company as one of the parties. The power company's system of distribution, permits by means of diversity, of a smaller aggregate reservoir capacity for the district, and a co-operative schedule would not compel, but merely induce, continuous use of power. By placing the benefits of diversity within the control of the consumer himself, co-operative effort will be the natural result, and the same or even better results will be obtained with less investment in reservoirs.

Readiness to Serve Schedules.

These schedules, also called Doherty schedules, are based upon a correct analysis of the costs of rendering the service. The application of the schedules to actual practice is difficult, and introduces complications that are not warranted by the results. A segregation of the various expenses into consumer, demand and output expenses, is absolutely in accordance with the variations that will exist in the form of use by different consumers, and as will be noted later the co-operative schedule, proposed hereafter, is based upon these factors, under application of the law of averages, but with the one difference, that it gives a constant rate to any one consumer, as long as his method of use does not vary more than a fixed percentage from that whereby his original classification was determined.

In commercial power in general, and in irrigation as well, a day is the smallest commercial cycle in operation. Therefore, the method of use or non-use of 1 kw. maximum demand during 24 hours should be the basis of any schedule rather than the month. Additional factors may account for the variations of the use over the month, and others again for variations over the year thus indicating seasonal variations.

It hardly conforms to present accepted thought on the subject of charging methods to advocate a complication of the schedules for the sake of promoting the interests of all concerned.

May we not, however, in justification of such complications point to railroad freight tariffs and to the maze that they convey to the layman, while advancing the claim that the complications of a schedule are

unavoidable, inherent to the business and desirable from every point of view, excepting perhaps that of simplicity.

In order to do full justice to all facts that have bearing upon rates or schedules for any one class of service, and in this case for irrigation service, we must take into account the inter-relation of lighting and commercial power service. This applies especially in large unified systems such as are now operating in Southern California. The mutual influence of the use by different districts, communities and consumers of different classes, the diversity of use, or in general, the non-coincidence of peak loads due to all consumers under the system is directed by the power company to produce better service and lower rates, such as would not sustain an isolated business of smaller proportions. The commercial features of the processes of unification of the large systems have brought about enormous systems of transmission and distribution over which energy is shifted in accordance with the demand, and in view of the fact that considerable parts of these systems were smaller isolated system at one time, the tendency has been to have more distributory equipment than would be installed now if the entire system were to be reproduced at this time. In the meantime, we have the means, by a more intelligent and specified use of the service to minimize future additions to existing systems, thereby reducing the investment upon which returns must be earned.

Distance, under present acceptance by the decision of the railroad commission, is not allowed as a factor in the establishment of rates for different districts, and we have in this decision a splendid application of the law of averages, and also of the introduction of a co-operative element into rate making. When it is realized that judicious application of the law of averages underlies the very principle and success of co-operative methods, it is evident that a co-operative schedule may contain a considerable measure of application of this law, provided that it does not introduce unjust discrimination. Instead of applying the law to the method of use as is now clearly the case in all existing schedules, it is more equitable and more clearly within the meaning of co-operation, to apply this law to various consumers, eliminating the size distinction that now prevails. The size of the consumer should not be as important a factor in determining the rate to which he is entitled, as is now the case in most schedules. While it is a fact that the investment per 1 kw. maximum demand required for service on the premises of a consumer becomes less with increased size, it is not in a proportion as now accepted, and furthermore, the law of averages applied to size would still do justice to the total investment as incurred by the power company.

In accordance with the above, it is proposed to obtain a condition whereby under equivalent methods of use, a 10 kw. consumer and a 100 kw. consumer will have a different rate for the service, only to the extent of a difference in the average investment per 1 kw. maximum demand.

The power company with a definite number of kw. maximum demand available in its generating plants, and with a given distributing system, is confronted with the problem of approaching ideal operating con-

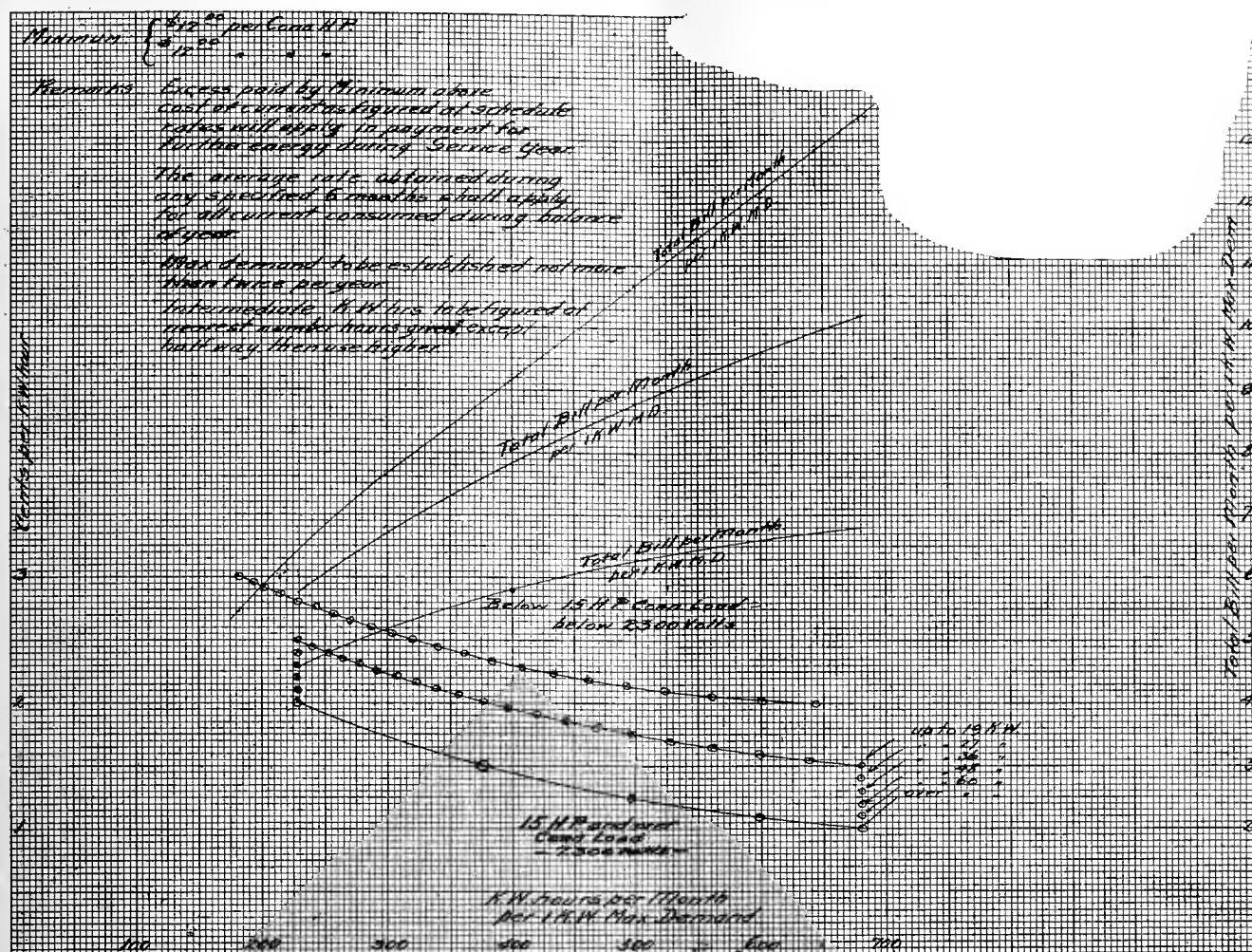


Fig. 3. Maximum Demand or Load Factor Schedule.

power. The consumer should also be required to show the use of a fixed amount of energy each month, and at least within a reasonable percentage of the amount under which he qualified for the rate that he is being charged per kw.-hr. Repeated or systematic failure to use this given amount, should cause a higher rate to become applied to his bill, and he should lose all rights upon the original rate.

The above outline of the use of the proposed schedule shows that it serves to classify customers according to their method of use, and that therefore the fact that the bill for long hour users is smaller than for short hour users, does not lead to unjust or improper discrimination. To the contrary, it is in direct recognition of the influence of investment charges upon short hour users, as compared with the influence of output charges upon long hour users. Both long and short hour customers should receive the full benefits of diversified use. Therefore, for any one class of consumers we must introduce diversified use over the system as a whole. While everybody familiar with rate-making problems knows the effect of diversity, and knows the value of the so-called diversity factor, it may be opportune to make here a distinction between forms of diversity. The principal difference that I desire to refer to, is that of definite and indefinite diversity. The more definite that diversity becomes, the more service may be given by the power company per 1 kw. maximum demand in any part of

the system. When we compare, for instance, the periods during which demand may be made upon the system by a residence and a pumping plant, we find not only that the period for the former is shorter, but also that the time of occurrence of the demand is more definitely known. The knowledge of this time of occurrence may be more or less definite, but in any case constitutes a means whereby the power company may claim an unearned income in view of the fact that the consumer wants unrestricted use of the service at all times. The mere fact that in actual operation this use becomes more or less defined, results in an advantage to the power company for which the consumer pays, and should pay, as long as he is not willing to define the time of use. Definite diversity should therefore be the aim not only of the power company, but of the consumer as well. Rotation of pumping plant operation, specified days and hours of use, either through or off the peak, are effective means of reducing the cost of power under co-operative methods.

No attempt will be made here to offer figures for the corrections that should be made in the base rate under the schedule, to allow for limited service, such as mentioned above, but there is unquestionably a set of corrections that would do justice to the facts. These corrections should be made, after all other corrections for diversity, due to the power system as a whole, have been made. I call attention, in this connection, to the seasonal diversity that is caused by the rela-

tive change in the loads due to lighting during the winter months, and the loads due to pumping for irrigation, that are a minimum during the winter and during the times that lighting places the highest demand upon the system as a whole.

Summarizing my conclusions, I wish to make it clear that the above does not question the fairness of the gross income earned by the present power companies upon their investments in properties as they are today, and further that the proposed schedule does not intend sweeping changes in the rates but rather in the charging method. Also, I believe and hope that

HISTORY OF ELECTRIC TRANSMISSION.

BY G. O. WILSON.

[Continued.]

(This installment of Mr. Wilson's series is concerned with details of European and American progress from 1896 to 1900.—The Editor.)

While these large powers were being developed throughout the United States, progress was being made much more slowly in Europe. From 1891 to 1896, most of the power notes in the English journals referred to American practice; only a few small transmission plants were recorded in Europe, and practi-

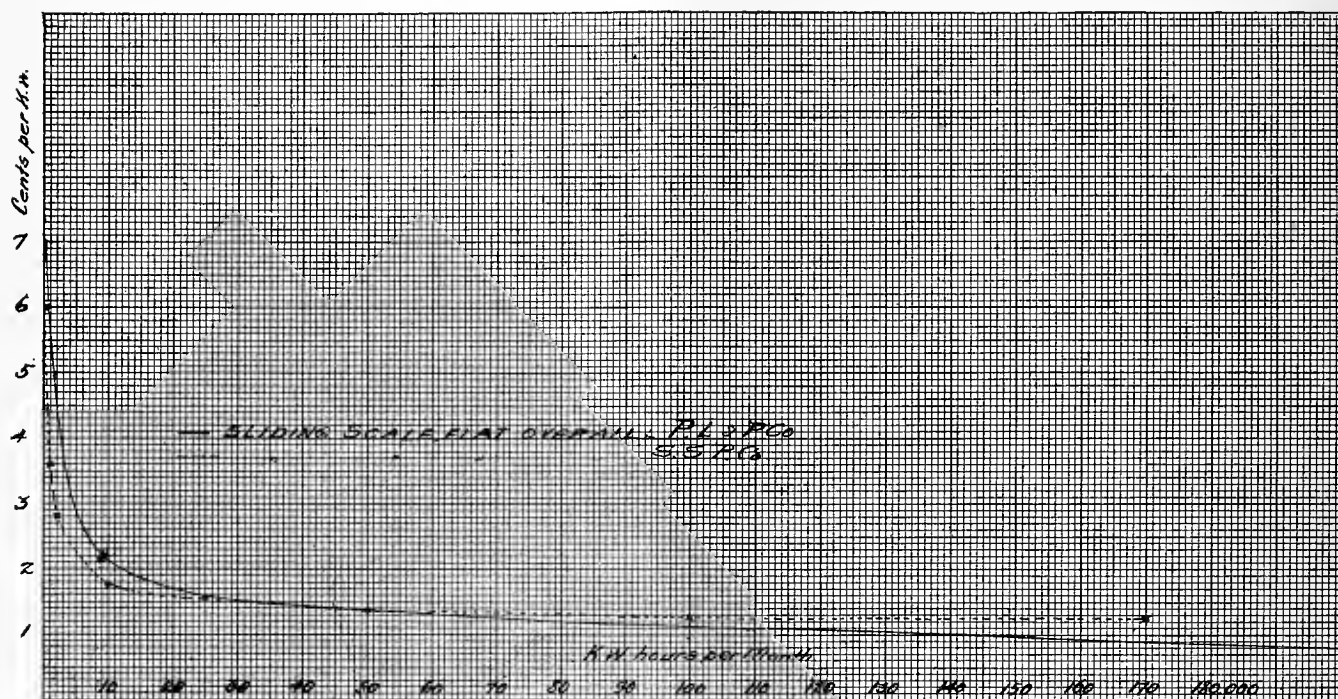


Fig. 4. Cumulative Sliding Scale Schedule.

I have shown that there is room for improvement in the relationship between the power company and the consumer, and that whenever the relationship becomes a co-operative one, important means will present themselves whereby more general and extensive use of power may be brought about. Finally, the co-operative schedule as proposed here will cause a more equitable distribution of the charges that make up the total gross income as derived from all customers under a system, and a gradual reduction of rates as the logical result of co-operative effort.

Safety rules to be observed in the operation and maintenance of electric generating stations and substations, and on the overhead and underground distributing wires in connection therewith, have been prepared for publication by the United States Bureau of Standards. In this work the Bureau has consulted a large number of operating companies, workmen actively engaged in the different lines of work covered by the rules, as well as State industrial and public service commissions. The rules have been formulated so as to be complete and simple, and as easily understood as possible. It is believed that they will be of great value to State commissions, city authorities, and operating companies, and will tend to reduce accidents in this important industry.

cally no progress took place in England on account of the unreasonable obstacles placed in the way of promoters by the British Parliament, which body seemed to fear that if private capital were permitted to build up power projects, the various small, inefficient municipal generating plants throughout the kingdom would be put out of business. As an example of the lengths to which the authorities went in this obstructive policy, it is interesting to note that as late as 1902 there was a law on the English statutes prohibiting the transmission of more than 1000 kw. of energy over a single line.

On the Continent, progress was also slow, only a few power stations being in commission in 1896, the date of the opening of the Buffalo transmission, which were on a larger scale than the very early plants of Tivoli and Locle already mentioned. In 1895 a 300 h.p. plant was installed near Genoa, Italy, the energy being transmitted 18 miles at 6000 volts d.c. In the same year a 1200 h.p. station, transmitting 6 miles at 4000 volts single-phase, was established at Neufchatel, in Switzerland. This was the earliest alternating current commercial plant of large size in Switzerland. The same year saw the first 10,000 volt a.c. line in France, 200 h.p. being transmitted 14 miles from the River Ardieres at this pressure, and early in the following year, 1896, the same voltage was reached in

Germany, where 255 kw. was transmitted a distance of 15 miles.

From 1896 to 1900 the industry of power generation and transmission went ahead in great strides in Continental Europe and America, although still practically dormant in England. In Europe, the step from 10,000 to 12,000 volts was made in 1897, when a plant at Steinamanger, Hungary, began transmitting 900 h.p. a distance of 38.4 miles at the latter pressure. The same high voltage was introduced in France, at Lancy, in 1898, the distance of transmission being only 25 miles. By the end of this year Switzerland also had a 12,000 volt line at Montboven, the current being single-phase, and a 6000 h.p. plant transmitting three-phase power 24 miles to Bozen at 10,000 volts. There was also practically completed at Kanderwerk a station to transmit 1800 h.p. 25 miles to Berne at the high pressure of 16,000 volts, three-phase, the highest voltage in Europe at that time. Italy was also beginning the development of its water powers, and early in 1899 the line from Paderno to Milan, a distance of 20 miles, was placed in commission, transmitting 13,000 h.p. at 14,000 volts, three-phase. The largest plant at St. Maurice, Switzerland, from which 10,000 h.p. was to be transmitted 42 miles to Lausanne at 25,000 volts d.c. under the Thury system, was almost completed in 1899; and in the same year the French plant at Locle was increased to 3200 h.p. capacity, and the voltage was raised to 14,000 volts.

While this progress was thus being made in Europe, during the four years from 1896 to 1900, great strides were being made in America, both in the United States and Canada. By the end of 1897 the full 15,000 h.p. was being developed at the Niagara Power Company's plant, and there was sufficient demand for power in Buffalo to warrant the construction of the second line on the vacant half of the original pole line. At the same time a contract for the seven other generators necessary to increase the capacity of the plant to 50,000 h.p. was let, and these were all delivered and in operation by the end of 1899. The beginning of a large addition to the power house in the gorge was also made in 1899.

The Canadian Niagara plant was still undeveloped at the beginning of the twentieth century; but many other large systems in Canada were well under way. Both Montreal and Quebec started in 1897 the large hydroelectric systems that were to grow up in the territory adjacent to them in the years to come; 10,000 h.p. was transmitted from the Richelieu River to Montreal, a distance of 25 miles, at a voltage of 12,000, two-phase. Quebec was supplied from two points. The first 3000 h.p. of a proposed 9000 h.p. plant at Lachine Rapids was installed during this year, and transmitted $5\frac{1}{2}$ miles to Quebec at 4400 volts, three-phase; and 480 kw. was installed at Three Rivers and transmitted 17 miles to the city at 12,000 volts. In the following year, there was completed at Hamilton, Ontario, the then longest and highest voltage line east of the Rockies; 2000 kw. was transmitted 35 miles at 20,000 to 24,000 volts, two-phase. In 1899, Quebec and Montreal both added to their power supply. At Quebec, 3000 h.p. was added to the Lachine Rapids plant, and a new power house was completed at the St. Gabriel River, the 1500 kw. generated here being

transmitted 18 miles to Quebec at 20,000 volts, three-phase.

Near Montreal, a new power house was completed at Chambly; 8000 kw. was generated here, (with a proposed early extension to 16,000 kw.) and transmitted $16\frac{1}{2}$ miles to Montreal at 12,000 volts, three-phase. Two other transmission lines built in Canada during this period are worthy of notice. The line transmitting 1500 kw. (with a proposed early enlargement to 3000 kw.) 32 miles from Kootenay to Rossland, B. C., at 11,600 volts, three-phase, is interesting because it was a pioneer in the rigorous climate of Western Canada. And a municipal plant transmitting 960 h.p. $18\frac{1}{2}$ miles to Orillia is interesting because it was the first use of aluminum for transmission in Canada.

While these rapid developments were being made in Canada during these years, the United States was equally active, in many places besides Niagara; 1897 saw several large California projects completed. At Bakersfield, 900 kw. was transmitted 25 miles at 11,000 volts. The Blue Lakes power house was started with a capacity of 1350 kw., and the power was transmitted at 2400 volts, two-phase, to a number of neighboring mines, the maximum distance of transmission being 17 miles. During the year also the work of building the 80 mile, 3000 kw., 33,000 volt line from Santa Ana to Los Angeles was begun, this being the longest in the world at that time.

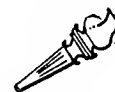
Early in 1898, one of the most notable projects in the country was put into operation by the Pioneer Electric Power Company near Ogden, Utah. The 5000 h.p. generated at the power house of this company was transmitted 36 miles to Salt Lake at 28,000 volts, three-phase. This project enjoyed for a few months the record of the highest commercial voltage used in the world, but before the end of the year the 32 mile line from Provo to Mercur was put into operation at 40,000 volts. Experiments at 50,000 and 60,000 volts were made at Telluride, Colorado, during this year; but an iron telegraph wire was used, and the power transmitted was not in commercial quantity. In this same year, California had three new lines of importance, although not of as great dimensions as the above Rocky Mountain projects. The Newcastle-Sacramento line transmitted 800 kw. 28 miles at 16,000 volts; the Yuba-Marysville line transmitted 1080 kw. $18\frac{3}{4}$ miles at 16,700 volts; and the San Gabriel-Los Angeles line transmitted 1200 kw. 23 miles at 17,000 volts.

The year 1899 saw several large projects completed in this country. The Southern California Power Company's 81 mile line from Santa Ana to Los Angeles was placed in commission, and 3000 kw. was transmitted at 33,000 volts, and the line carrying 3000 kw. from Colgate 76 miles to Sacramento equalled the Provo voltage of 40,000. In Michigan, a 20 mile line from Allegan to Kalamazoo was used to convey 2700 h.p. at 25,300 volts. The Seattle line from the Snoqualmie Falls power house was completed, and 4000 kw. was transmitted over its 31 miles at 30,000 volts; the 45 mile Tacoma branch was also nearing completion. A 40 mile line from Blue Lakes to Stockton was also completed, and power was transmitted over it at 25,000 volts.

[To be continued.]



LIGHTING METHODS



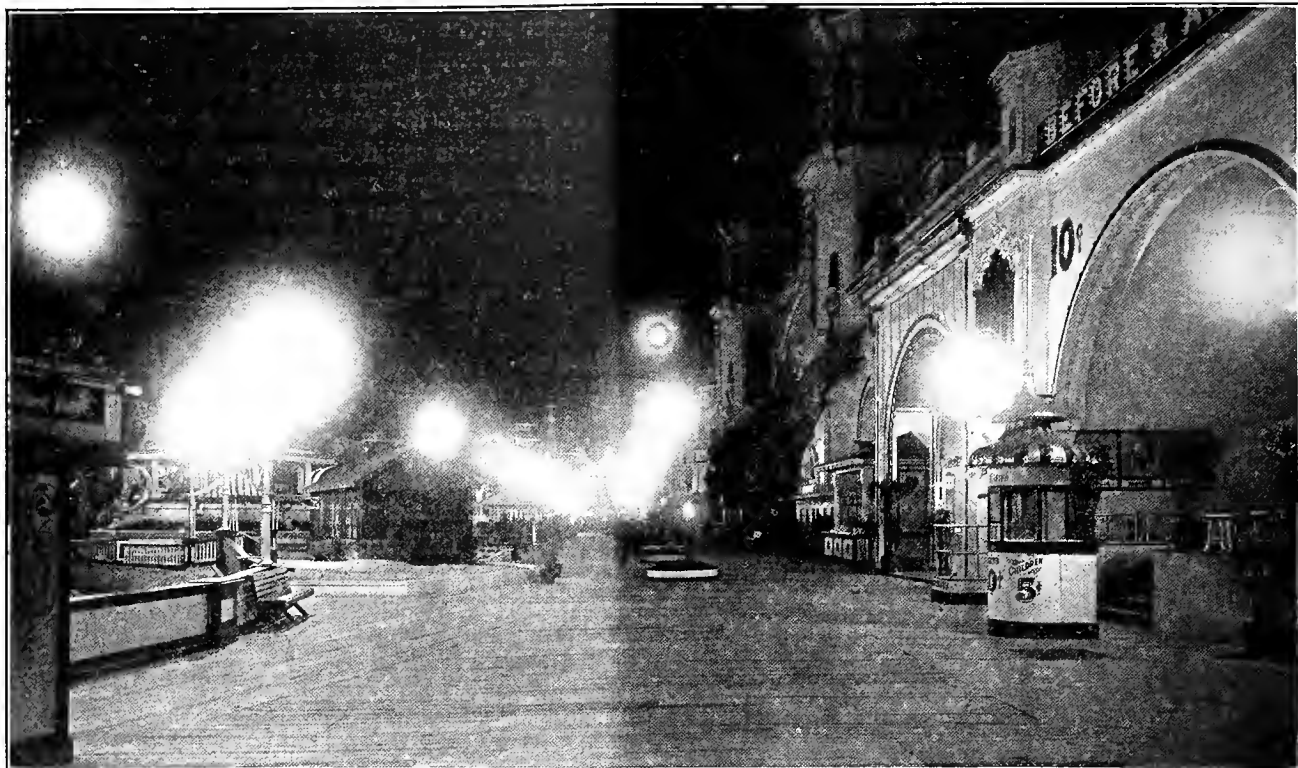
AMUSEMENT PARK LIGHTING.

BY A. L. POWELL.

The managers of attractions at summer resorts have long sought a lighting equipment which would require little or no attention. The incandescent lamp

must be a certain amount of brilliancy for best advertising value.

Recent changes in the construction of the Mazda lamp have materially improved the efficiency of light generation; have produced a whiter light, and made



Night View, Luna Park, Coney Island, N. Y., Showing 750 Watt Mazda Lamps.



Night View of a Portion of White City Park, Chicago, Ill., Showing Application of 1000 Watt Mazda Lamps.

was ideal in this respect, but heretofore was not available in large enough sizes to give the great efflux of light sometimes necessary for this class of service. Not only must the light be of a high intensity, but there

possible very high candlepower lamps with relatively small bulbs.

The amusement parks have been quick to see the advantages of these lamps, and installations are scattered throughout the country. Photographs have been taken of several of these and it is of interest to show a number. At Luna Park, Coney Island, over eighty 750 and 1000 watt Mazda lamps are used. This particular view shows the lamps lighted alone, with the outline lighting extinguished. A ventilated weather-proof holder contains the Mogul socket and supports the diffusing globe which surrounds the lamp, thus protecting the eye. Over the main walk shown at the center, the fixtures are placed, in two rows, about 16 ft. above the ground, long wire spans being the means of suspension. At the left, around the lagoon, and at the right in front of the concessions, ornamental iron standards serve to carry the equipment. The effect is spectacular, the standard of lighting is high, and although everything is very bright, glare is not noticeable.

At White City Park, Chicago, a considerable number of high efficiency Mazda lamps for general and special lighting are used. One picture shows the tank of the "Deep Sea Divers" in the foreground, and the "Maid of the Mist" attraction in the rear. Each of these is lighted by four 1000 watt Mazda lamps in a

standard out-of-door fixture. This consists of an ornamental, ventilated casing over the socket, a heart-



Brilliant Lighting Provided by High Efficiency Mazda Lamps at White City Park, Chicago, Ill.

shaped diffusing globe, and a porcelain enamel reflector. The other view is of the "Figure Eight" ride which uses five 1000 watt Mazda lamps with the type fixture which has just been described.

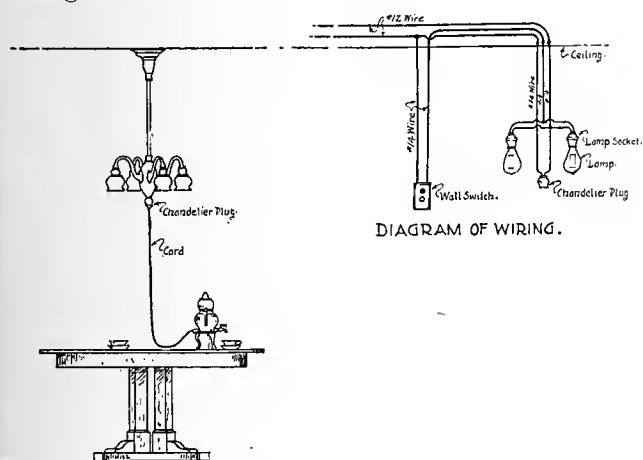
CHANDELIER INSTALLATION.

BY CHARLES T. PHILLIPS.

Providing for Electric Cooking Devices.

Due to the increased use of electric cooking devices, such as percolators, tea samovars, toasters, chafing dishes, etc., on the dining table, the scheme shown here is recommended as an inexpensive means of providing for same.

The lights are controlled independently of the cooking devices.



Specifications call for the wiring to center outlet in dining room (and other room as required) with one circuit of No. 12 wire. Bring out three wires at outlet, one common, one from wall switch and one from ahead of wall switch.

The fixtures should have sockets for lights and one 10 ampere chandelier plug. Wire the stem of the fixture with two No. 14 and one No. 18 wire. Connect to wiring so plug will be ahead of wall switch.

ERRORS IN POWER MEASUREMENTS DUE TO INSTRUMENT TRANSFORMERS.

BY W. M. SHEPARD.

(Following an analytical discussion showing the cause and effect of errors introduced in power measurement because of current and voltage transformers, the author makes suggestions whereby they may be compensated or reduced to a minimum. Mr. Shepard is special solicitor with the San Francisco office of the General Electric Company and joint author of the "Watthour Meter."—The Editor.)

Errors introduced into wattmeter and watthour meter readings through the use of instrument transformers are of two kinds, (1) errors in ratio and (2) errors in phase angle. The magnitude of these errors will depend on the characteristics of the transformers and the amount and power factor of the load being measured and the power factor and volt ampere load on the secondaries of the instrument transformers.

In order to bring out the reasons for these errors, it is necessary to go briefly into the relations between primary and secondary currents and voltages of the current and voltage transformers.

Fig. 1 is a vector diagram of a current transformer.

OI is the line current.

OX is the exciting current.

OM is the magnetizing component and XM is the energy component of the exciting current.

I_p is the component of primary current which balances the current in secondary.

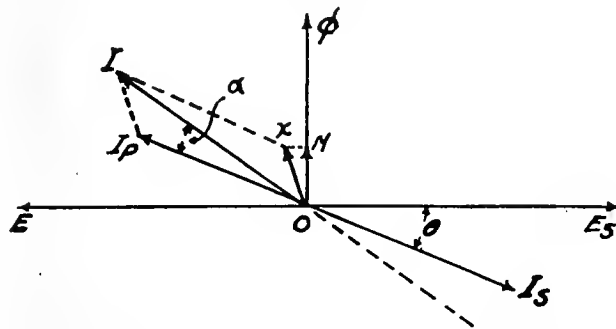


Fig. 1. Vector Diagram of Current Transformer.

I_s is secondary current and is equal to IP divided by N , where N is the ratio of secondary to primary turns.

$O\phi$ is magnetic flux in transformer core.

OE is voltage induced in primary.

OE_s is voltage induced in secondary.

θ is angle of phase displacement between secondary current and voltage.

Cosine b is power factor of secondary load.

α is phase angle of transformer; it is the angle by which the secondary current is displaced from its 180 degree relation to the primary current and is due to the exciting current taken by the transformer.

n is ratio of current transformer and equals I divided by I_s .

N is ratio of primary to secondary turns and equals I_p divided by I_s .

If the exciting current OX was zero IP would be equal to and in phase with I ; α would disappear and n would equal N .

It is evident that the exciting current is responsible for the errors of the current transformer and it is therefore important that the exciting current be kept

small if accurate results are expected from the transformer.

The exciting current of a current transformer will vary with the volt ampere load on the secondary; being larger the heavier this load, as a higher voltage will have to be induced in the windings to force the current through the higher external impedance connected in series with the secondary.

The phase angle of the current transformer depends not only on the exciting current, but also on the power factor of the volt ampere load on the transformer secondary. In other words, it depends also on the angle θ in Fig. 1. This is evident from Fig. 2.

It is seen, from Fig. 2, that at a certain value of θ the phase angle α disappears. The error in ratio, however, is a maximum at this point.

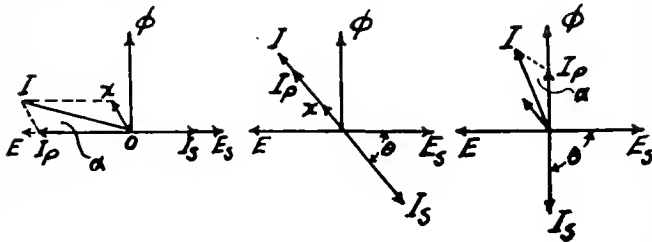


Fig. 2.

The effect of ratio error, with heavy secondary load, is to make meters connected to the secondary register low at all loads and especially at light loads.

With very light secondary loads the ratio error may be such as to make the meters register high due to the fact that the true ratio will approach more nearly the ratio of turns and the ratio of turns is somewhat less than the rated ratio of the transformer.

With current transformers of fair design, this latter error is negligible.

The effect of errors of phase angle is negligible at unity power factor, but for lagging power factor makes the meters register high. For leading power factor the effect is to make the meter register low. The power factor referred to is the power factor of the load being measured.

If current transformers are used without potential transformers, this may be a source of considerable error. The effect of the potential transformer phase angle is to counter-balance that of the current transformer and so reduce any errors from this source.

Current transformers should never have their secondary circuits opened when current is flowing in the primary. This is not only on account of the high voltage which will be induced in the secondary if a large primary current is flowing, but also because the characteristics of the transformer may be changed due to the excessive magnetizing current (line current), as if the secondary is closed or the primary circuit opened under these conditions, the core may remain in a permanently magnetized state. It will then take a higher magnetizing current under ordinary conditions and both its ratio and phase angle will be changed. If this should happen the core can be demagnetized by operating the current transformer with open secondary circuit and gradually reducing the primary current to zero, or by very gradually cutting out resistance in the secondary circuit (starting with high resistance) until it is short circuited.

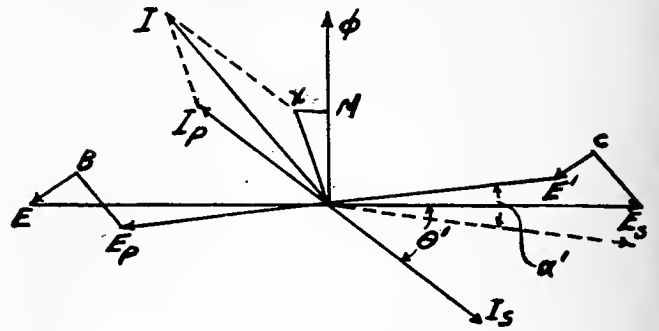


Fig. 3. Vector Diagram of Voltage Transformer.

Fig. 3 is a vector diagram of a voltage transformer.

OE is the primary terminal voltage.

OE_p is the primary induced voltage.

Oe_s is the secondary induced voltage.

Oe is the secondary terminal voltage.

OX is the magnetizing current.

OIs is the secondary current.

OIs is the primary current.

α' is phase angle of transformer; it is the angle by which the secondary terminal voltage is displaced from the 180 degree position with respect to the primary terminal voltage.

n is actual ratio of transformer and equals OE divided by Oe .

N is the ratio of turns and equals OE_p divided by Oe_s .

N is the ratio of turns and equals OE_p divided by OEs .

BE_p is primary resistance drop.

CE_s is secondary resistance drop.

BE is primary reactance drop.

CE is secondary reactance drop.

Cosine θ is power factor of the load on the secondary of the voltage transformer.

The impedance drop in the primary and secondary windings is responsible for the phase angle α' . If the resistance drop exceeds the reactance drop Oe will lead the 180 degree position with respect to OE . This condition exists in standard voltage transformers and is desirable as this displacement in phase of the secondary voltage is in the same direction as the phase displacement of the secondary current transformer, when used with ordinary meter loads and so, in a measure, cancels the error from this source introduced by the current transformer.

The regulation of voltage transformers is poor due to the high resistance drop. The amount of secondary load which can be supplied from one transformer with a fair degree of accuracy is therefore small.

If the phase angle α of the current transformer equals the phase angle α' of the voltage transformer there will be no phase angle error. Ordinarily this is not the case and where a very high degree of accuracy is required in watt-hour meters the difference between these angles is made up in lagging the meter.

When the phase angles completely cancel each other, the watt-hour meter should be lagged so that the flux from the potential pole is exactly 90 degrees behind the impressed voltage in phase.

If the phase angles α and α' do not completely cancel each other the meter should be lagged so that the phase of the flux from the potential pole differs from

the 90 degrees position by an angle β such that $\beta = \alpha - \alpha'$.

The watt-hour meter should be lagged for $(90 - \beta)$ degrees instead of for 90 degrees flux lag as ordinarily required.

Errors due to ratio can, to a certain extent, be compensated for by adjusting the meter at unity power factor taking into consideration these errors, as shown by the ratio curve of the transformers.

The errors in ratio of the current transformer vary with the line current and to compensate for this on light load the light load adjustment of watt-hour meters is set to make the meter fast on light loads, as the effect of the current transformer is to make it slow at light loads.

The amount of adjustment necessary in the watt-hour meter will depend on the characteristics of the current and voltage transformers and the amount of load connected to the secondaries of these transformers.

The amount of adjustment should be determined from the characteristic curves of the transformers.

The first oil motor ship to be built in the West was recently completed at Seattle by Nilson & Kelez. This boat is now being used in the cannery trade, being driven by a four-cylinder, 120 h.p., four-stroke cycle Diesel engine. It is 87 ft. long, 17 ft. beam and 7 ft. draught. The dynamo, auxiliary pumps and small compressor are driven by a 12 h.p. unit and a 9 h.p. unit drives a hoist. The trial trip showed a fuel consumption of $6\frac{1}{4}$ gallons of Star oil per hour at a speed of 10.3 knots.

Infusorial earth is being mined more actively in California and Nevada, which produced nearly 90 per cent of the 6528 tons output last year in the United States. The value averaged \$10.50 per ton. Heretofore diatomaceous or infusorial earth has been largely used as an abrasive in the form of polishing powders and scouring soaps, but the United States Geological Survey finds that of late its uses have been considerably extended. Because of its porous nature it has been used in the manufacture of dynamite as a holder of nitroglycerine, but so far as known not in the United States. Its porosity also renders it a non-conductor of heat, and this quality in connection with its lightness has extended its use as an insulating packing material for safes, steam pipes, and boilers, and as a fireproof building material. In this country a new use of the material is reported in the manufacture of records for talking machines. For this purpose it is boiled with shellac, and the resulting product has the necessary hardness to give good results. In Europe, especially in Germany, infusorial earth has lately found extended application. It has been used in preparing artificial fertilizers, especially in the absorption of liquid manures; in the manufacture of water glass, of various cements, of glazing for tiles, of artificial stone, of ultramarine and various pigments, of aniline and alizarine colors, of paper, sealing wax, fireworks, gutta-percha objects, Swedish matches, solidified bromine, scouring powders, papier-machie, and many other articles. There is a large and steadily growing demand for it.

LETTER TO THE EDITOR.

Criticism of Seattle Lighting Department Cost Data. To the Editor:

J. D. Ross, superintendent of lighting, the official head of the municipal lighting plant of Seattle, Washington, has issued a biennial report for the years 1912-13 covering the operation of his department. As published in your issue of July 25th, the report sets forth in great detail general and unit costs of the plant and its component parts. These costs are in many instances very low and give the impression that the municipal lighting plant of Seattle has been constructed at a remarkably low cost. These hydroelectric costs data are, however, not founded on facts, and a study of them will disclose that the superintendent has drawn on his imagination in order to show low costs. In order that such costs shall be of any value at all, they must be based upon facts and absolutely square with the truth.

The total cost per kilowatt of the generating system is given as \$82.96. The method adopted to obtain this result is quite unusual and his figures do not mean anything, although apt to deceive the taxpayer. His method of arriving at the cost per kilowatt of the generating system is to take the total cost at the end of 1912 of crib dam, penstocks, power station, transmission lines, city substation and Lake Union auxiliary station, and divide each one of these costs by 15,500 kw. (assumed capacity of the system), add these dividends together and obtain the figure of \$82.96 per kw. The capacity of the crib dam is given at 9000 kw.; of the penstocks, 11,000 kw.; of the Cedar Falls generators, 13,500 kw., and of the Lake Union auxiliary, 1900 kw.

Now as to the capacity of the penstocks, 11,000 kw., Mr. Ross recently testified at North Yakima before the Public Service Commission of the State of Washington, "the pipes will probably fail at about 11,000 kw., even if we had all the water." He has repeatedly stated officially when urging the acquisition of additional water powers by the city that the plant was up to its capacity at 10,000 kw. As a matter of fact, the maximum output of the Cedar Falls plant at any time as shown by the load data sheets kept in the power house occurred in November, 1913, and was 10,100 kw., and the superintendent testified at a Public Service Commission investigation at North Yakima recently that the Cedar Falls plant was overloaded last winter a few times when the Lake Union auxiliary had to help out. This is the maximum that the plant is capable of generating and the proof of this is that the lighting department was compelled to purchase additional power from the Schwager-Nettleton sawmill and also run the Lake Union auxiliary over the peak load last winter when the Cedar Falls plant was operating at its maximum of 10,100 kw. The report also states that the maximum load at all generators for 1913 was 10,625 kw., and this evidently includes Cedar Falls, Lake Union auxiliary and Schwager-Nettleton plants. The rated capacity of the generators at the falls, two 1200 kw. and two 4000 kw., aggregate 10,400 kw., and this is the capacity that will be used in determining the cost per kw. of the generating system, although the limit-

ing factor in determining this cost should be the maximum output that the plant is capable of delivering—10,100 kw. It will be noted that the capacity of the 4000 kw. machines is placed at 5000 kw. each and the 1200 kw. machines at 1750 each, a total of 13,500, while later the Lake Union 1500 kw. machine is rated at 1900 kw., a total of 15,400 kw. for all, and this figure for the purpose of the superintendent's calculations has been raised to 15,500 kw.

The investment figures of the generating system for 1912 were taken to show the unit cost per kw. of the system. Why were not the 1913 investment figures used, which are somewhat greater than the 1912, inasmuch as they are given in the same report? The 1912 figures will be used to show that the superintendent's cost of \$82.96 per kw. is far too low, and then the cost per kw. at the end of 1913 will be shown for the system, exclusive of the Lake Union auxiliary.

The investment in crib dam, penstocks, falls plant, transmission lines and substations as given in the report for 1912 is \$1,190,448.66. To this should be added certain items, such as transmission line right of way, city substation sites, Cedar station furniture and material at Cedar Falls, amounting to \$29,397.28, making a total investment of \$1,219,845.94, which on the basis of 10,400 kw. rated capacity gives a unit cost of \$117.29 per kw. of the generating system exclusive of the Lake Union auxiliary plant. There was an additional investment in this plant on account of the construction of the new Cedar Falls dam. The reports show that up to December 31, 1912, the sum of \$618,528.65 had been expended on this new masonry dam. The dam is being erected below the crib dam, and the contract calls for a dam carried up to practically the same height as the crib dam, which will therefore add but very little to the present capacity of the plant. The cost of this dam should be taken into consideration in arriving at the cost per unit of the plant.

The cost of the Lake Union auxiliary plant is given as \$6.16 per kw. based on 15,500 kw. This of course means nothing and is misleading. The rated capacity of this plant is 1500 kw. and cost \$95,550.32 up to December 31, 1912, and the unit cost would therefore be \$63.70. The load factor of this plant is entirely different from that of Cedar Falls, the plant being used only in emergencies and at times to carry the peak of the system. It cannot be classed as a capacity plant for the reason that the Water Department which owns the reservoir will not permit the water to be drawn from the reservoir for a longer period than two hours at a time without service, on account of depletion of water, and if the plant is to be run for any long period, two hours' notice must be given by the Lighting Department to the Water Department in order to give the water in the pipe line time to move, otherwise the pipe leading to the reservoir from Cedar River would collapse. The Lighting Department pays the Water Department one cent per kw.-hr. for all power generated at the plant and in 1913, 54,500 kw.-hr. were generated, which is the output of the plant at normal rating and 100 per cent load factor for 36 hours. Attention is here called to the fact that 45,100 kw.-hr. were purchased during the year from Schwager-Nettleton Mill Company to help out, and why this power was not generated at the Lake Union

substation is not explained, unless it is that the Lake Union plant is only available in emergencies. Since the hydraulic development was made by the Water Department, and the Lighting Department installed the generating plant, the latter occupies the position of a purchaser of power. It would therefore be proper to capitalize a part of this charge of one cent per kw.-hr. and get a unit cost and add this to the \$63.70 per kw.-hr. above obtained in order to arrive at a fair cost for the Lake Union plant, which the superintendent states cost only \$6.16 per kw.

It is interesting as well as instructive to work out the cost per kw. of the Cedar Falls plant at the end of 1913, and see how this compares with the superintendent's figures for combined generating system at the end of 1912.

The investment for crib dam, penstocks, power station, transmission lines and city substations totals \$1,236,454.08, and to this sum should be added certain other items, such as transmission lines, rights of way, city substation sites, Cedar Falls station furniture, tow boats and materials, a total of \$45,847.34, making a total investment of \$1,282,301.42, which, based on the rated capacity of the plant, 10,400 kw. (the maximum ever obtained being only 10,100 kw.) gives a cost per kilowatt of \$123.30.

In addition to this there had been expended on the new masonry dam up to December 31, 1913, the sum of \$1,037,807.28, which, when completed to the contracted height, approximately that of the old dam will not materially increase the capacity of the plant and which adds \$99.79 to the above cost of \$123.30 thus making the total cost of the generating system \$223.09, instead of \$82.96 per kw., the reported cost of the system, including the Lake Union auxiliary, at the end of 1913. The investment in the dam, when completed to approximately the same height as the crib dam, will be \$1,250,000, without materially increasing the capacity of the plant, but it will bring the cost per kilowatt of the system up to \$243.49.

It is unnecessary to comment further on this costs data. The cost figures in the report in a great many cases are inaccurate and full of "the sins of omission and commission," and cannot, as the superintendent states in his preface, make the report "a valuable reference volume."

Aug. 1, 1914.

SUBSCRIBER.

An "appropriator" of water, as defined by the Supreme Court of Nevada and reported in the Reclamation Record, is one who obtains water for irrigation from a water company diverting water from a stream into an artificial waterway for sale within the rule that a prior appropriation is a prior right and the company is but his agent, and the right of user is equivalent to an easement in the artificial way of the company to the extent of the amount of water delivered by the company, which right is contingent only on the acts of the actual appropriator in paying a reasonable compensation for the water obtained. It was also held that the right of an actual appropriator of water for beneficial use is a part of the freehold whether it is obtained by diverting it from a natural course or by purchase from a water company.

RESUME OF DIESEL ENGINE INSTALLATIONS.

(Discussion by San Francisco Section of the American Institute of Electrical Engineers, on paper by L. R. Jorgensen printed in this journal May 23, 1914.—The Editor.)

W. M. Smith:—I would like to ask Mr. Jorgensen whether the records that have been given in his paper are based on mineral oil as fuel, that is, crude oil or petroleum that is treated in some way? Also is it not a fact that the Diesel engine is supposed to be suitable for burning almost any kind of (I was going to say refuse) very low grade liquid fuel? I have understood that coal tar and such compounds were suitable for use in a Diesel engine, and I have had the impression refuse which was really not suitable for any other use, or not suitable as fuel in any other way, was suitable for this work in a Diesel engine.

L. R. Jorgensen:—A large Diesel motor, especially if it has a slow piston speed, can use an oil containing a large percentage of asphalt; but a small engine, where the valve openings are necessarily small, will require better oil. The engines can even use crude oil from which the gasoline has been taken. The "Siam" took some oil on board in San Pedro which was too thick; it worked fairly well from San Pedro to San Francisco; but they were not going to take a chance on it after they left San Francisco because the ship was afterward to sail in colder water, and the oil was already so thick that the feed pump had to raise the pressure up to 85 atmospheres in order to squeeze it through the valve openings. If the oil is so thick that the feed pump would have to raise the pressure up to 100 atmospheres, the safety valve would open up, and no oil would enter the cylinders. The Diesel engines can readily use any oil where the asphaltum is not over 25 per cent. Of course you cannot use Diesel engines everywhere, because you cannot get oil everywhere; but between this coast and Europe any ship can use Diesel engines to advantage. But on vessels running between the continent and English ports it would not pay to install Diesel engines, because oil is so much higher than coal in England.

A. H. Babcock:—I think Mr. Jorgensen has drawn the picture very mildly of the ease and simplicity of handling the engine room of the "Siam." It was entirely too short for most of us. We would have been glad to have made a much longer voyage. The engines are almost unbelievably prompt in response to bridge signals; and further than that, there is none of the preliminary slow movement in reversal or starting that we are accustomed to see in the steam engine. There is a positive air pressure of 20 atmospheres, if I remember correctly, back of the starting valve; and the consequence is that within a turn, or two turns at the most, your screws are going practically at full speed. I think it would be very easy to get too high torque on the first few strokes, and to go past the decavitation point. In fact, as I remember the handling of the engine, it was necessary to notch the starting lever back very quickly after the first explosion occurred in order to prevent the racing of the engine. It is very difficult to speak without over enthusiasm on the impressions of that trip. The engine room was so quiet—I mean by that, that there was no running around; all the gear was within easy reach. One of the most impressive features of the trip was the exceedingly prompt reversal from full or half speed ahead on one engine and full ahead on the other, to both full astern in a very few seconds.

There is one point of view in connection with the paper I would like to emphasize a little: I think the speaker has been too modest about it. He knows a good deal more about Diesel engines than he has told us; and for that reason he presented the adverse side as well as the favorable side. The paper has taken into account more of the general view of the subject than we are accustomed to see. In the last

meeting of the Mechanical Engineers it did not seem to me that all the facts were brought out, and I stated so in discussion that night. That paper followed a very common tendency of the enthusiast—to speak of one side of the subject, and to overlook the things that count against it; whereas all engineers are concerned with the sum total of the work, which, as I have said many times, is shown by the auditor's balance sheet.

There are places where the Diesel motor is clearly not the proper prime mover. On the other hand, there are places where it is clearly the best thing to put in. My personal feeling is that the Diesel will become a serious factor in our every day life for installations where the load factor is reasonably high, say from .6 to .8. In other words, the nearer you approach to ship practice the more economical will be the use of the Diesel motor. On the other hand, I cannot imagine putting a turbine into such a ship as the "Siam" any more than I can imagine putting a Diesel engine into such a power house as drives one of our railroads. The two are utterly unthinkable from the engineering standpoint. The one is concerned with a very nearly constant load, in which the Diesel is certainly to be reckoned with; and the other is concerned with an extremely fluctuating load, where, if the first costs, and consequently the fixed charges, are to be kept within reason, the cost of installation must be kept down. And there must be large over-load capacity. Take, for instance, the steam turbines in one of our large railway stations; it is not at all uncommon to see a machine loaded up to 200 per cent momentarily, sometimes 250 per cent, and almost while you are wondering what is going to happen the load drops off to may be one-quarter full load. I cannot imagine a Diesel operating with any economy, with any satisfaction, under such conditions, whereas the steam turbine does very well.

So I would add emphasis to what the speaker has said; that it is quite necessary not to be led away by enthusiasm over a high thermal efficiency to the point where one will overlook the other features. For example, cost of lubrication (which for small units is very high comparatively speaking) and the fixed charges that always have to be reckoned with.

I would emphasize again the point that it is refreshing to listen to a paper that does take into account both sides of a very important question.

L. R. Jorgensen.—A Diesel motor could be used to advantage in a central station (if the engines could be built large enough) where the motor could run for 24 hours on full load, and the steam turbine could take the rest of the load, so that the Diesel motor utilized its full economy during 24 hours. The hot gases, if exhausted under the boilers, could keep several boilers hot, so that if anything happened to the transmission line, the boilers would be ready to deliver steam to the turbines.

The Diesel motor is very much in the same fix as a water power plant. It seldom pays to build a water power plant if you haven't a good load factor for it; but it pays to have in combination with it a steam turbine, because the steam turbine is the most economical device known to take care of the load fluctuations.

The great advantages that a two-cycle motor has over a four-cycle motor are its cheapness, its smaller weight and less floor space required. In a ship of large size this last item does not count, as, according to the rules in force for measuring ships, the power plant must take up at least 13 per cent of the total cubic contents of the ship.

It is an international agreement that 32 per cent of the volume of a ship is subtracted in measuring up for harbor taxation and canal toll purposes in case the machinery occupies at least 13 per cent of the total space; if it occu-

pies less, however, nothing is subtracted. A four-cycle motor can generally be put inside this 13 per cent limit; and nothing would be gained by having much idle space in the engine room, and to make the engine room smaller than the 13 per cent limit would only cut down the earning power of the boat.

Of course this does not hold true in the case of a war vessel, where much power must be produced with a given weight of machinery in the smallest possible space.

Mr. Howell:—As Mr. Jorgensen and Mr. Babcock have stated I agree that the Diesel engine should only be used where you have a good load factor. For instance, in Sherman, Texas, the load factor of the lighting plant is only 29 per cent. The best that they can do is to produce electricity at a cost of .68 of a cent per kw.-hr. This cost includes the lubricating oil, fuel oil, cooling water and cleaning material, average repairs for two years and labor, but does not take into account depreciation, taxes, etc. The plant is equipped with three 225 h.p. Diesel engines, two of them are running most of the time, one occasionally on the light loads, and sometimes three.

As regards the consumption of lubricating oil, I might say that it is rather high with small engines of 100 h.p., but with an engine of 225 h.p., the guarantee consumption for lubrication is eight quarts for 5400 b.h.p., or about 1.8 grams per b.h.p.

In reply to the request of Mr. Jorgensen regarding Diesel engines in submarines, the United States Government adopted in 1909 the 4-cycle Nuremberg engine because the Otto gasoline engine formerly used was dangerous. The gasoline exposed through the carburetor into the boat, caused explosions, none of which were fatal to the boat, but which caused many casualties.

A great many troubles were encountered with the air compressor on these 4-cycle Diesel engines, because the compressor had to furnish a large volume of air, and was driven directly off of the crankshaft. The lubricating oil consumption was rather high; (about ten gallons per 100 b.h.p. for a 24 hour run or 80 gallons for 800 b.h.p. for 24 hours running.) This was due to the high speed.

The submarine is provided with a generator which may be used as a motor or a generator alternately, the Diesel engine drives this generator to recharge the storage batteries. The backlash of the 4-cylinder, 4-cycle engine caused the risers from the armature of the generator to drop. The United States Government then adopted a six-cylinder, 4-cycle engine of 500 b.h.p., 420 revolutions, with a little better designed air compressor, and they did not have as much trouble with the engine as far as the electrical equipment was concerned, but they did have trouble with the valve mechanism and the air compressor. However, the boats that were recently built at the Union Iron Works went to San Diego without mishap. The engines weighed 200 pounds per b.h.p.

The Nuremberg people and the Sulzer people have developed 2-cycle engines. The Sulzer engine has a separate scavenging cylinder, which with the six cylinders, makes a seven-cylinder engine. The Nuremberg engine has a step piston, the larger piston being below the working pistons, to carry a pressure of 5 lb., above atmosphere to scavenge the cylinders. The air compressor is mounted on one end, (lately built with the different stages mounted radially). These compressors are not in general use however, (due to the high cost). The 2-cycle engine weighs about 88 lb. per b.h.p., the latest one built for the Italian navy, weighed 44 lb. per b.h.p., the space occupied by them is about one-half that occupied by 4-cycle engines for the same h.p.

The power of these engines has increased to 1250 h.p., for the new submarine boats, and they are now building engines which will develop 1800 h.p. Engines of 8 cylinders each, originally designed for 800 h.p., when put on the test

block gave considerably over 1250 h.p., showing that they are capable of a big overload capacity, though not as great as turbines. The mean effective pressure in the engines of submarines is 117 lb., instead of 110 lb., as in the ordinary stationary Diesel type of engine. All of the submarines in Europe are equipped with 2-cycle Diesel engines, the 4-cycle having been superseded.

According to Lloyd's rules, if you save space, with a Diesel engine installation, you are not allowed to use all for cargo, but must keep part for future machinery installations if deemed necessary.

As regards the marine Diesel engine we must obtain the proper propeller speed. The engine room space will enable you to have separate air compressors. In the "Siam" or ships of its class, they have two air compressors. If one breaks down it does not necessarily tie up one of your engines. With the submarine, however, if anything happens to one of the air compressors, as it is on the same shaft with the engine, then that engine is out of commission until the air compressor is repaired.

It is generally known that when using a mechanical atomizer, you must first prepare the oil, take out the grit and dirt and heat it so it will flow, and it must contain approximately 18,000 B.t.u. A Diesel engine can burn any oil that can be burned underneath the boiler, provided the same treatment is given to the oil that would be required to burn it under the boiler. In Germany they burn coal tar, by pre-heating. They also burn earth nut oil in Africa. This oil contains about 14,000 B.t.u. per pound.

I now will explain why the fuel oil taken on board the "Siam" at San Pedro, was discharged at this port. The "Siam's" fuel pumps were built for a working pressure not exceeding 65 atmospheres. When this vessel arrived in San Francisco, they called upon me in a consulting capacity, as regards their oil.

The chief engineer of the "Siam" stated that with the San Pedro fuel oil that the pressure (due to viscosity), and asphaltum content 55 per cent, exceeded 65 atmospheres. He feared that the pumps would probably break when they got into a colder climate, and as they were going to Vladivostok, and were not equipped with heating coils, they changed from San Pedro fuel oil to Star fuel oil. The "Siam" recently reached Hongkong, and had absolutely no trouble with the engines from the time she left that port until her return. The fuel oil economy was bettered 10 per cent with the Star fuel oil, as compared to Borneo fuel oil, which she originally operated upon.

In California, the best oil to use for continuous use, running the engine 300 days a year, would be a little better grade of oil than crude oil; the Standard Oil Company put out what is commonly called Star fuel oil, a standard grade of oil with 25 per cent asphaltum, perfectly clean, and free from foreign impurities.

Guy Bailey:—It seems to me, one thing has been overlooked of some interest to power plant engineers, and that is that the Diesel engine in small sizes has an efficiency comparable to the larger sized units. I think that is a characteristic that is not shared by other forms of prime movers. In small isolated plants in particular that may be a decided advantage. I would like to have Mr. Jorgensen say something about that.

L. R. Jorgensen:—That is a fact; and that is also the reason why the Diesel motor is a success in small isolated plants, and not in large central stations yet. One thing must not be forgotten, that they cost twice as much as an ordinary steam engine installation. A Diesel motor of, say 200 h.p. size, costs about \$60 a horsepower.

The calculation of the profit to be gained by using a motor on a ship instead of a steam engine will in the case of the ship "Selandia" look about as follows: The engines of the "Selandia" cost about \$19.50 per h.p. more than a

steam plant would have cost, or a total of \$48,600 more for the same displacement. To pay for this there is 1000 tons more freight on three voyages per year Copenhagen-Siam, or a total of 6000 tons at \$4.86, or a total of \$29,160. A ship like the "Selandia" will save at least \$24,300 worth of fuel per year; and if we figure only 500 tons of extra freight per trip, the total savings per year will be \$38,880. The engine room force in the "Selandia" consists of three engineers, four assistants and two oilers. A single screw steamship of the same size would have three engineers, three assistants and 10 firemen (coal). There is therefore a still further saving in the motor boat in the labor expense. The fuel-oil tanks can be completely filled in eight to ten hours with a minimum amount of labor, and the twelve hoists on deck are electrically driven with the motors acting as generators when load is going down, all with a view towards economy.

W. H. Smith:—I would like to know if Mr. Jorgensen has any figures on the cost of stationary plants. We know, for instance, on a first-class steam turbine power plant it will run around two pounds of coal per kw.-hr. on a large public utility, say, anywhere between 24,000 to 28,000 B.t.u. per kw.-hr. generated. Now are there any figures available on the basis of using fuel oil at some different figure than say 19,000 B.t.u. per pound? What is the net result with a Diesel motor?

L. R. Jorgensen:—Here on the Coast are two or three firms I believe that make smaller Diesel motors, and any of those firms will guarantee the fuel consumption for those small engines of .45 lb. per brake h.p. I do not think it pays to make a smaller Diesel motor than say 50 h.p., but that would be a safe guarantee if they can make the engine at all—less than half a pound of oil per brake h.p. It is true that the economy is not so very much different in a small engine and a large engine, although in a large engine the fuel consumption should come down to .36 lb. of oil per brake h.p. I should say that a 50 h.p. engine has probably twice as high an economy as a 5000 h.p. steam turbine.

R. B. Scott:—I have had a little experience with Diesel engines using California oil. It is as good a fuel as you can put into a Diesel, provided it is treated in the right manner and the engine is in good condition. You can get an engine to clog up on kerosene if you want to. If the engine is not adjusted properly, valves leaking, or you are not getting the proper air pressure, you can soot up your valves as well as you can with California crude oil; but if the engine is in proper working condition, and your fuel injection is work-as it should be, your valves are all tight, the California crude oil or Star fuel oil is as good a fuel as you can put in a Diesel engine.

I had the first California oil sent home to the old country about three years ago, and tested an engine out on it; the oil then was said to be as good a fuel as you could wish for the Diesel engine. Since then I have made tests with crude oil 16 degrees gravity in the Diesel engine and there is no question the engine will run on it; but if you are to run steadily on this oil, and your load is going to fluctuate, you must heat the oil so that the governor will cut off quick enough, so that you get the quantity of fuel delivered into the cylinder to suit the load on the engine. The difficulty is that the action of the governor will lift the suction valve of the fuel pump, by passing the oil to suit the load on the engine, and the heavy oil will not pass quickly enough through the fine opening between valve and seat. The oil I used was 16 degrees gravity oil with 70 per cent asphaltum and just like molasses. It took a day and a half to fill the 100 gallon drum with a two foot fall from the tank through a one inch pipe. The engine ran on this oil for a week; but had the oil been heated it would have been much better. The only danger was that when your engine was running light or had not load enough, the governor would not be cutting off the oil, and the engine would not be burning it, so the oil going into the cylinders would clog up the valves and pistons.

There is of course the question of climate. You take this oil here on a cold morning you cannot get it to move, but by noon the pipes are warm and it runs all right.

The Standard Oil Company's Star fuel was 19,000 B.t.u. and 24 degrees Baume, 25 per cent asphaltum, and is a better fuel than I used in the engines in Pahang, which was Borneo oil 18,500 B.t.u., 24 degrees Baume, and petroleum base. Roughly speaking, we used in the engines in Pahang, which were rated 200 b.h.p., 200 imperial gallons per day of 24 hours, seven days per week right along, with Chinese looking after the engines. You can take the cost of California oil at one dollar per barrel, and figure it up roughly at one imperial gallon or 9.5 lb. per day of 24 hours per brake h.p. On one occasion I put in a 45 b.h.p. Diesel engine to supersede a steam pumping plant. I had oil fuel under a Babcock boiler, and two Knowles Duplex steam pumps, the plant delivering 2½ tons of water per minute, 100 ft. head, to supply the stamp battery and mill. The average fuel consumption was from 650 to 700 gallons daily. The Diesel engine drove by belt and clutch a three-throw geared pump delivering three tons of water per minute; the average fuel consumption was 37½ gallons per day. This engine and plant has been running for the last eight and a half years. In the four years the plant was under my charge the cost of repairs, that is, renewals of any part, did not cost five dollars Mex., \$2.50 gold. Of course the valves had to be cleaned and ground in at stated times, which is classed as care of the engine, and is generally done by the engineer when the engine is running, spares being kept ready at all times. So far as actual repairs on the Diesel engine are concerned, with proper care they need far less than the steam plant of equal size. I have put up and have had the care of both steam and Diesel plants, and can quite appreciate the difference between them in regard to repairs. In a steam plant over and above renewals occasionally required, you have all the joining and packing both for engine and boiler, that has to be renewed all the time. On the Diesel the joints are all metal to metal, and when a good job at the start, that finishes it. You cannot have a leak on the Diesel engine, as at the high pressure you are working you are going to cut the faces, and in a few hours it will be absolutely useless. The Diesel in regard to repairs is a long way ahead of the steam plant.

In regard to central station work, I may tell you that in Hongkong they have Diesel engines that superseded steam. The steam plant was Billis & Morecomb engines and generators, B. & W. boilers, with oil fuel. They put in a 300 b.h.p. Sulzer Diesel engine and generator to run the day load, and it helped the steam plant to handle the peak load at night. The Diesel ran for 24 hours for less than it took to bank the fires under the boilers. They installed another 500 b.h.p. Diesel as a stand-by, and the steam plant was for sale. This was four years ago. In some cases there is no question but what the Diesel engine is suitable for central station work. The trouble is in the initial cost; when you get to sizes of 5000 b.h.p. and over the slow speed of the Diesel causes the cost of the generator to be high compared to one of the same power for high speed steam turbines—this along with the flexibility of the steam turbine in taking care of heavy momentary overloads. It is not that the Diesel engine is not more economical than the steam turbine or reciprocating engine at all loads, but the difference in initial cost. As Diesel engines are developed and become more general in use, this may even itself up. The outfit with the Diesel will give you the b.h.p. for far less than the steam plant. I have made 571 kw. on the switchboard to the barrel of oil with a 150 b.h.p. engine with California oil.

In regard to tar as fuel for the Diesel engine, I know of a case where the refuse tar from the Paris gas works is used in Diesel engines supplying light and power. I have this information from Mr. Chas. Day, managing director of Mirreles, Bickerton & Day, Ltd., Stockport, England, large Diesel engine builders.

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Comparisons may be odious, but they often form the basis of intelligent action in the world of trade and commerce. A discussion in this issue describes the successful application of the Diesel engine, giving especial emphasis to its value for marine propulsion.

It is unnecessary to now delve further into the economies and the other advantages of this method of propulsion or to here note the limitations of present types of Diesel engines, which limitations themselves dangle opportunity before the inventive mind.

It might, however, be of service to glance into the past in order that we may with more encouragement look forward into the future. The clock that ticks the centuries has swung far over, the escapement has resounded and the return journey of the pendulum has commenced since the first power-propelled ships were used for commercial purposes. At that time a feature ship advertised by one company was described as "a handsome and stout steam vessel, having two engines of the power of twenty horses each, with two copper boilers, and having safety valves and everything of the most approved principles," and so forth.

The century since escaped has left to the world a steamship tonnage legacy of over forty-five millions, and the "two engines of the power of twenty horses" are insignificant compared even with the horse power of engines of present-day motor ships—the latest nurslings of the sea, created at the dawn of what may prove a new era in marine propulsion—though even the largest of these is in turn insignificant compared with the engines of the leviathan liners now necessary for trans-Atlantic service.

And that the tonnage growth of steamships has been accompanied by a still more remarkable growth in the efficiency of marine engines points to the enormous possibilities contained in further improvements in oil motors.

There is apparently no saturation point in power boat development—the word "power" being here used to cover the entire range of mechanically propelled ships—for during the past year an increase of over two million tons was registered throughout the world; a remarkable expansion over so short a period.

In 1883, the year usually understood to be that of the starting of the new United States navy, the amount appropriated for this purpose was less than fifteen million dollars, while for 1913 it was one hundred and forty million dollars. It is more than probable that this amount will continually increase.

On the Pacific Coast growing interest is with the opening of the Panama Canal, being manifested in shipbuilding; the realized need for the more rapid development of Pacific Coast industries being an added stimulus.

The extensive use of the Diesel engine here is practically certain, and this will aid California in unloading her burden of oil.

To the young man and to the man of older years, though young in purpose, this field is shown, through these comparisons, to offer untold prospects and opportunities. It is a claim worth filing on and cultivating.

Service Connections

A utility distributing system, like the proverbial work of a woman, is never completed. Each group of new consumers calls for extensions which must be financed, often a matter of great difficulty. The moot question as to who shall pay for service connections, the company or the consumer, has finally been decided in California by the State Supreme Court in favor of the consumer, the company being required to pay the cost.

The Miradero Water Company had questioned the right of the State Railroad Commission to order that water connection and meters be furnished without charge to the people of Glendale, a city which had not yet elected to surrender its power over public utilities to the commission.

The court holds that the commission has the right to make the order but that its enforcement rests with the municipality. It furthermore holds that under its franchise provisions the water company has not performed its full duty until service pipes have been laid to the consumer's premises. This ruling is equally applicable to telephone, gas and electric companies and definitely clarifies a situation that has long been a bone of contention.

It must not be thought, however, that service connection means service extension. While the California Commission has already gone on record as not approving the practice of refusing to make an extension unless the proposed customer pays for it, the U. S. Supreme Court has ruled that unprofitable service extensions virtually amount to unlawful taking of the company's property for the private use of another and that municipalities have no power to require such extensions. The Wisconsin Railroad Commission has also ruled that compulsory service extension is subject to the limitation that there shall be a reasonable expectation that the consumption will warrant the necessary preliminary expense.

The question which seems to remain for decision, consequently, is when is a connection not an extension. It may be the answer is bidden in the word "reasonable."

The powers of the initiative have been invoked to put on the ballot for the next general election in California a measure providing for universal eight hour labor in the State. Such wide-spread opposition has already been developed against this proposal that there is little likelihood of it becoming a law. Nevertheless we deem it our duty to call the attention of the engineers to its vicious features.

Eight Hour Labor Law

The law reads as follows:

Any employer who shall require or permit, or who shall suffer or permit any overseer, superintendent, foreman or other agent of such employer to require or permit any person in his employ to work more than eight hours in one day, or more than forty-eight hours in one week, except in case of extraordinary emergency, caused by fire, flood or danger to life or property, shall be guilty of a misdemeanor, and upon conviction thereof shall be fined not less than Fifty (\$50) Dollars nor more than Five Hundred (\$500) Dollars, or imprisonment in the county jail not less than ten (10) nor more than ninety (90) days, or both so fined and imprisoned.

The first effect of such a law would be to limit production, particularly in those industries of a sea-

sonal character, such as agriculture, where intensive work is necessary for brief periods in order to save perishable products.

Its provisions apply to the home as well as the factory and practically prohibits domestic help for families with limited means. The absurdity of its provision, when carried to this logical extreme, is self-evident.

But the most important matter for consideration is that this proposal discriminates against one state in favor of others where such limitations are not put on industry. Its enactment would represent business suicide.

Closely allied to industrial betterment and workers' welfare is the matter of providing safety devices. Danger divides attention, and thus diverts energy. All other factors in production should be subordinated to safety. While this has been practiced for every twenty years in Germany it is only within the past few years that public utilities, particularly electric railways, have recognized its importance.

Safety First

"Safety First" is now the slogan literally "the army cry," under which a multitude of public utility employees are working. Prevention of accidents has thus become an integral part of service and the day is not far distant when there will be a national board of accident underwriters whose duties will be directed along parallel channels to those of the National Board of Fire Underwriters. All machinery, such as electrical apparatus, will be subject to inspection, as likewise will all buildings.

Most accidents are due to heedlessness. Constant contact with danger results in its being ignored. The mind becomes calloused to danger. Safety appliances are useless unless the mind is also alert.

The campaign for accident prevention is started with those most directly concerned. Employees are taught lessons in caution by means of lectures, demonstrations and literature; "safety committees" are being established, and as a result there will not only be fewer accidents, but also an increased interest in the care and upkeep of the plant.

Similarly the public should be taught to exercise care. School children are being educated in the principles of safety, public meetings are being addressed by safety engineers, moving pictures are being used to reach those otherwise inaccessible, and every effort is being made to get public co-operation in concentrating their mind on possible danger.

Such prevention of accidents will do more to solve the problem of claims for damage than all the methods of adjustment and all the employer's liability legislation which human ingenuity can devise. Since this movement was started by the electric company in Seattle four years ago the cost of accidents have been reduced one-half. Instead of spending 10 per cent of the gross railway receipts to meet damage claims, this amount has been reduced to less than five per cent. The plants in which safety first has been applied show greater profits.

But far above these mercenary considerations this movement for safety first has a deeper-lying significance in its recognition of the interest of humanity and its conservation.

PERSONALS

H. A. Kluegel, engineer for the Yosemite Power Company, is at San Francisco.

Seton Porter, member of the firm of Sanderson & Porter, is at San Francisco from New York.

A. J. Myers, Pacific Coast manager for the Wagner Electric Manufacturing Company, is at Los Angeles.

J. G. Loveday, an electrical contractor at Santa Barbara, Cal., was at San Francisco during the past week.

Prof. J. G. Lister, lecturer, B. C. E. R. Technical School at Vancouver, B. C., is spending a vacation at Butte Inlet.

J. C. Rendler, president of the Southern California Electric Company, Los Angeles, was a visitor in San Francisco this week.

A. E. Griswold, president of the A. G. Electric Company, Seattle and San Francisco, arrived in the latter city the first of the week.

C. M. Brewer, manager Western States Gas and Electric Company, Richmond, Cal., was a visitor to San Francisco during the week.

G. A. Schneider, sales engineer of the Western Electric Company, San Francisco, left for a several days' trip through the Tahoe region.

Mort K. Dodge, district manager at Seattle, Wash., for the Standard Electric Time Company, visited Vancouver, B. C., during the past week.

Carl Simmons, railway engineer of the Westinghouse Electric & Manufacturing Company, is making an inspection trip along the Pacific Coast.

H. V. Carter, president of Pacific States Electric Company, San Francisco, returned to San Francisco after an extended stay in Southern California.

W. S. Berry, sales manager of the Western Electric Company, San Francisco, returned the first part of the week from an extended trip through Mendocino county.

James W. Stokes, formerly line foreman for the San Joaquin Light & Power Company, has succeeded **Ralph Bearden**, who recently resigned as agent at Corcoran.

E. C. McBrerty, representative of the American Electric Heating Company, Detroit, Mich., is expected in San Francisco in the near future on a trip of the Pacific Coast.

Harry H. Hornsby has resigned as conduit and supply sales manager of the Sprague Electric Works, at New York City. He will announce his future plans in the autumn.

L. W. Prichett, manager of the new business department of the El Paso Electric Railway Company, is traveling through California on a month's vacation and visiting his parents at Santa Barbara.

B. R. Ellis has been appointed vice-president and purchasing agent of the Williams Water & Electric Company, which has superseded the Grand Canyon Electric Light & Power Company at Williams, Ariz.

N. E. Maddox has resigned as fixture specialist by the Inter-Mountain Electric Company of Salt Lake City to accept a position in a similar capacity for L. A. Hufschmidt Manufacturing Company of San Francisco.

H. E. Lichenstadt, manager Titan Electric Supply Company, Ltd., of Trigete, Austria, is visiting cities in the Pacific Northwest investigating the possibilities of securing the electric lamp business of the various central stations and jobbers.

W. M. Hitt has resigned as electrical engineer with the Public Service Commission of Washington to accept a position with Henry I. Lea, consulting gas engineer of Chicago, who is at present making a valuation of the Seattle Lighting Company.

E. C. Andrews, Sunbeam Lamp specialist of the Western Electric Company at Los Angeles, spent a few days in San

Francisco during the week en route home from Cleveland, Ohio. While there, Mr. Andrews was an attendant at the fourth annual convention of lamp specialists.

Sidney Marshall is president and manager of the Monroe Water Company of Seattle, which has taken over the plant and franchise of the Monroe Water & Light Company, Monroe, Wash. It is stated that considerable extensions and improvements are contemplated by the new company.

M. H. Crawford, formerly engineer for the Kuhn interests and recently associated with the bond firm of Kuhn, Hill & Company at San Francisco, has been appointed commercial manager for the Bakersfield district of the San Joaquin Light & Power Company to succeed **H. A. Jastro**, who recently resigned.

E. F. Stone, superintendent of lighting and power for The Arkansas Valley Railway, Light and Power Company at Pueblo, Colo., is president of the Manufacturers' Bureau of the Pueblo Commerce Club, an organization which is carrying on an active campaign to establish new manufacturing plants at Pueblo.

T. E. Collins, division manager of the Westinghouse Electric & Manufacturing Company at San Francisco, called together a representative meeting of about fifty members of the electrical fraternity at a local cafe on August 3, to learn their opinion as to the desirability of establishing a social club. The proposal met with great favor and various committees are now at work to report at a later meeting.

C. C. Cline, engineer British Columbia Hydrostatic Survey, is taking levels and setting up gauges on the Sumallo and Nicaloon Rivers with a view to making a report on the work in connection with the proposed water power development of the Canadian Northern. **G. Jansen**, engineer of the railroad company, is also in the field. This activity is due to the fact that the United States authorities have withdrawn the objections to the proposed development which were based on the probability that the operations would dangerously lower the Skagit River which crosses the boundary and is therefore subject to international consideration. The 50,000 h.p. developed will be transmitted to Port Mann to be there distributed for the operation of the company's system from that point to the False Creek terminal at Vancouver, B. C.

TRADE NOTES.

The Western Electric Company has awarded the contract for the construction of a six-story re-inforced concrete building at Eighth and Santee street.

Otto B. Goldman has received the contract to furnish and install one deep well type pump direct connected to a 15 h.p. phase-wound Westinghouse motor at Lafayette, Oregon.

Frank A. Stevens Company of Los Angeles, California, sales agents for Simplex crude oil burners, have opened a salesroom at 1105 Mission street, in charge of **L. F. Halloran**.

Newberry-Bendheim Electrical Company has opened an electrical equipment shop at 724 South Olive street, Los Angeles. A stock of supplies and appliances is to be carried for the retail trade, contractors and consumers.

The **Allis-Chalmers** Company, San Francisco, has recently sold 31 motors to the **Hollenbeck-Busch** Planing Mill Company, a complete hydroelectric plant, including a 500 h.p. impulse wheel and alternating current generator and motors to the **Engel-Cooper** Company, and an 800 h.p. motor to the Pacific Coast Steel Company.

OUTLET BOXES AND PLATES IN KNOB AND TUBE CONSTRUCTION.

James M. Barry, chief of the San Francisco Department of Electricity, has ruled that in knob and tube construction, code standard outlet boxes must be installed at all outlets, except that, when it is necessary to cut an existing finished surface to set such a box flush with said surface, approved outlet plates will be accepted in lieu thereof. In any case substantial backing must be provided.



INDUSTRIAL



BENJAMIN SOCKETS FOR TYPE "C" MAZDA LAMPS.

As a part of the new line of fixtures for the new "gas filled" (Type "C") Mazda lamps the Benjamin Electric Manufacturing Company has placed upon the market two new mogul base sockets. They are two-piece porcelain sockets with means for attaching to a flange or surface. The base portion carries the binding terminals. The latter are easily accessible for wiring. One illustration shows the type where the wires are brought in through side outlets in the upper portion; in the other through the central opening. The lower portion is provided with socket shell and bronze spring



Benjamin Mogul Base Sockets.

center contact. It can be used interchangeably with either base, and is attached by two screws which form electrical connections as well as furnish means of support.

Among the characteristic features of the Benjamin line of fixtures are their patent lamp grip, which prevents loosening and falling of the lamp, the provision for ventilation for protection against rain or snow, and the fact that the weight of the fixture proper is supported by the stem rather than the socket. A new two-color bulletin has just been issued covering this complete line of devices.

OVERLOAD RELAYS.

Continuity of service is an essential consideration in all installations, and interruptions of the service cannot be tolerated unless the protection of the apparatus demands it. When they do occur they must be confined to the smallest area possible. The time element features of the Westinghouse overload relay facilitate this.

Two forms of overload relay are supplied. Both have an inverse time element as shown in Fig. 1. In one of the forms

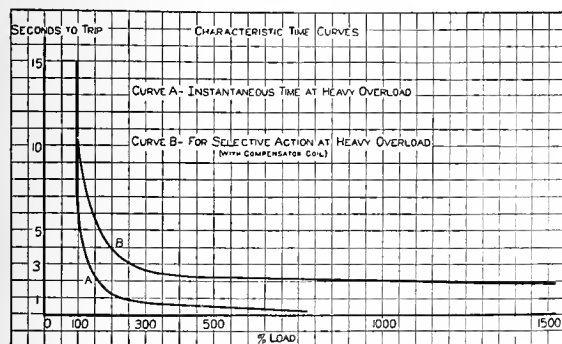


Fig. 1. Time Curves of Overload Relays.

(Curve A) which has been on the market for some time, the relay trips instantaneously at extreme overloads. In the new form (Curve B) there is an adjustable definite minimum time element. This definite minimum can be adjusted for any point from 0 to 2 seconds in the standard relays, and special relays can be supplied giving up to 10 seconds minimum.

The definite minimum time element relay provides a selective action where substations are placed in series at intervals along a transmission line, clearing the circuit at the last substation between the trouble and the generating station. Thus, suppose a generating station A, Fig. 2, with

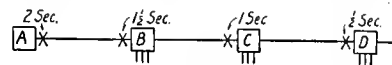


Fig. 2.

relays set for two seconds minimum, and substations B, C and D in series, with relays set for 1½, 1 and ½ second minimum respectively. If ground or short circuit occurs beyond D, relay at D cuts off the trouble section before the others operate so that the rest of the line remains in operation; if trouble occurs between C and D, relay at C will cut off the trouble; and so on.

Another use of the definite minimum time element, relay is in relieving circuit breakers. It is well known that the ultimate breaking capacity of a circuit breaker depends on the time of breaking. If a ground or short circuit can persist for two seconds before the circuit is opened, the ultimate breaking capacity is doubled, that is, the strain on the breaker is reduced to half, owing to the drop in voltage and current occurring during the interval.

This overload relay is manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

PUBLICATIONS RECEIVED.

Notes on Depreciation of National Gas Wells. Compiled by Samuel S. Wyer, Columbus, Ohio; 31 pp., 7x10 in.

"Acoustics of Auditoriums," by F. R. Watson. Bulletin No. 73, Engineering Experiment Station, University of Illinois, Urbana, Ill.

"Permissible Electric Lamps for Miners," by H. H. Clark. Technical Paper 75. U. S. Bureau of Mines, Washington, D. C. 21 pp., 6x9 in.

Future Regulation of Public Utilities, by Wm. D. Kerr, Bureau Public Service Economics, 17 East Thirty-eighth street, New York City; 23 pp., 6x9 in.

"Methods of Oil Recovery in California," by Ralph Arnold and V. R. Garfias. Technical Paper 70. U. S. Bureau of Mines, Washington, D. C. 57 pp., 6x9 in.

Toronto Municipal Electric System, results for 1913, by R. P. Bolton, Bureau of Public Service Economics, 17 East Thirty-eighth street, New York City; 12 p.p., 3½x9 in.

"Magnetic and Other Properties of Electrolytic Iron Melted in Vacuo," by Trygve D. Yensen. Bulletin No. 72, Engineering Experiment Station, University of Illinois, Urbana, Ill.

RADIO EXPERTS WANTED.

The United States Civil Service Commission announces that the following examinations will be held in San Francisco at an early date:

Expert Radio Aid (male) office of superintendent of Radio Service, Naval Radio station, Radio, Va.; \$8 per diem.

Expert Radio Aid (male), New York, N. Y.; Boston, Mass.; Philadelphia, Pa.; Norfolk, Va.; Charleston, S. C., and Puget Sound, Wash.; salary, \$6 to \$8 per diem.

Statistical editor (male and female), children's bureau, Department of Labor, Washington, D. C.; \$1200 to \$1400 per annum.



NEWS NOTES



FINANCIAL.

TACOMA, WASH.—The Washington-Oregon Corporation, operating power and water plants and street railway systems in Southwestern Washington and Northwestern Oregon, has been thrown into receivership. Federal Judge Cushman appointed Attorney Elmer M. Hayden temporary receiver. The receivership was asked by the Fidelity Trust Company, of Philadelphia, as trustee for a \$5,000,000 bond issue. The Washington-Oregon Corporation has properties in several Washington and Oregon towns. It operates a light and power plant at Hillsboro; a light plant at Rainier; the water plant and electric street car system at Vancouver, Wash.; a power and light system at Kalama, Wash., and light plant and electric car system at Chehalis and Centralia, Wash. Isaac W. Anderson, of Tacoma, is president of the corporation, and H. G. Fleischhauer, of Portland, is general manager.

INCORPORATIONS.

SAN FERNANDO, CAL.—San Fernando Telephone & Telegraph Company, \$50,000, subscribed \$5000, by J. M. Baldwin, J. P. Dunn, G. S. Batty and F. A. Powell.

LOS ANGELES, CAL.—Hammond Electric Bank Protection Company, \$500,000, subscribed \$500, by W. D. and B. N. Hammond, C. K. Berg, F. C. Mason and A. L. Brown.

MELROSE, IDAHO.—Farmers' Inland Telephone Company has filed articles of incorporation with \$2000 capital stock to build, equip and operate an independent telephone system.

RITZVILLE, WASH.—The Tannehill-Frantz Company has incorporated here with a capital stock of \$40,000, the object of the company being the manufacture and sale of electric time clock systems.

PORTLAND, ORE.—That water may be furnished to residents of Green Hills and Zionsville west of the city, the Green Hills Water Company has been incorporated. Articles were filed by John Bain, H. M. Esterly, Henry Hewett, W. H. Warrens, Frank C. Kelsey, B. M. Lombard, C. Henri Labbe, Howard T. Rankin and R. G. Jubitz. The cost will be borne by all users.

SAN RAFAEL, CAL.—For the purpose of building and operating a funicular railway at Sausalito from Water street near the Ferry building, along Excelsior street to a height of 500 feet, the Sausalito Incline Street Railway Company, has been incorporated here. The incorporators are: Geo. H. Harlan, Gideon H. Smith, John Mason and Miss Belle Herzinger of Sausalito and J. W. Vance of San Francisco. The capital stock is \$50,000.

ILLUMINATION.

LOS ANGELES, CAL.—The city council has promised that a system of incandescent lights will be provided for installation in the city parks.

WALLACE, IDAHO.—The annual budget passed at the last meeting of the council includes an item of \$3590 for street lighting purposes.

CARRIZOZO, N. M.—It is reported that the Wild Cat Leasing Company of Wild Oaks, is contemplating putting electricity into Carrizozo both for light and power.

NOGALES, ARIZ.—The common council has deferred action in the matter of the proposed new light franchise applied for by the Nogales Electric Light, Ice & Water Company, for 6 months.

ANAHEIM, CAL.—The city council has decided to have a committee visit a number of Southern California cities to inspect ornamental street lighting systems for the purpose of deciding on posts and obtaining data for a system to be installed here.

LOS ANGELES, CAL.—The board of public works has awarded Llewellyn Iron Works the contract for the installation of ornamental lamp posts and electroliers on Hollywood boulevard, between Cahuenga and Wilcox avenues, for the sum of \$1025.

CULDESAC, IDAHO.—The town board has granted to W. L. Marrs of Coeur d'Alene a franchise for operating an electric light plant. Mr. Marrs is to commence the work of installing the plant within the next two months, and light service will be established by October 1st.

SAN BERNARDINO, CAL.—Bids for the installation of a lighting system at Victorville have been opened by the Board of Supervisors. C. H. L. Ghriest was the only bidder and offered to maintain 100-candle power incandescent lamps at \$3.72 per lamp per month. His bid was taken under advisement.

SACRAMENTO, CAL.—The Sacramento Gas Company has begun suit in the United States District Court against the city of Sacramento to prevent the enforcement of the gas rate ordinance for the present year. It is claimed the rates are confiscatory. The suit is similar to one begun by the Pacific Gas & Electric Company two weeks ago.

PASADENA, CAL.—Important improvements are to be made at the municipal lighting plant. The commission has adopted specifications for another unit to be installed. Bids for steam turbine generator and jet condenser will be received up to August 11th. According to General Manager Koiner, of the municipal plant, the contemplated improvements will cost between \$30,000 and \$32,000.

PROVO, UTAH.—Within the next sixty days Provo will boast of its first "white way" and Academy avenue from Center street to First North, will be the first well lighted street in the city. The merchants have agreed to keep the lights going after their installation and steel poles have been ordered from the east for that purpose. The clusters of lights will be similar to those used in Salt Lake.

SALT LAKE CITY, UTAH.—No attempt will be made by the city commission to carry into effect the lighting district law passed by the last legislature. Accepting the opinion of the city attorney that the enactment is so "full of holes" that it would be foolish to act under it, the commission declined to test out the law as was desired by the state improvement league. Instead, the city attorney was instructed to prepare a bill for the next legislature overcoming the defects found in the present law. The intent of the law is to allow the city to create special lighting districts and assess the cost of improved lighting systems to abutting property owners, after the manner in which other street improvements are made. The law failed to specify the manner in which the assessment might be levied and was generally defective in its working provisions, according to the attorney.

TRANSMISSION.

BRUNEAU, IDAHO.—The Electric Light & Power Company intend building an electric transmission line from this town to Glenn's Ferry.

HAILEY, IDAHO.—The Hailey Electric Company is extending its lines to Ketchum so as to supply electric light and power to that town and vicinity.

PRINCE RUPERT, B. C.—Prince Rupert is fighting the entrance of the Prince Rupert Hydroelectric company. The municipality is building a system of its own and for this reason does not desire a privately-owned concern as a competitor.

ELLENSBURG, WASH.—Malcolm McLennan and R. B. Wilson of this city have given an option on 400 acres of land adjacent to the Priest Rapids power plant of the Pacific Power

& Light Company to Ernest Plummer, who it is thought is acting for the power company.

LOS ANGELES, CAL.—Suit has been brought by F. E. Hartigan to enjoin the city from using any of the \$6,500,000 bonds voted last May on the ground that the combination issue for the completion of the power plant and the construction or acquisition of a distributing system, was illegal.

TACOMA, WASH.—Mutual Electric Light & Power Company, by O. R. Kinney, president and A. Westbo, secretary, has filed application with the county commissioners for a franchise on Pioneer way and other roads in Puyallup valley for the extension of electric lines to furnish current for electric light and power for a farmers' telephone system.

BOISE, IDAHO.—The Idaho-Oregon Light & Power Company, with headquarters in this city, has resumed work on its Oxbow plant, the construction of which has been held up for a long time owing to the financial difficulties of the company. Receiver Ferris of the company has recently completed arrangements for the installation of 1-3600 k.v.a. Westinghouse electric generator in this station and it is expected that the unit will be ready for operation within thirty days.

PHOENIX, ARIZ.—To dam Little Colorado River two places near Tolchaco, to build power houses and 175 miles of transmission line to Globe, Ray and Hayden, and to produce electricity from most useless streams in Arizona, is the plan contained in voluminous filings of F. G. Baum, Special engineer from San Francisco, who has applied for a power permit in the United States Land Office. Little could be learned concerning Baum's backing in this project.

LOGAN, UTAH.—In consequence of an application by the Logan Mutual Power Company to the state engineer for 125 second feet of water to be taken from the north forks of the Logan River for power purposes, the people of this city have become considerably disturbed. The property owners are filing protests which claim it would mean the pre-emption of the entire stream by pipe line 18 miles in length, thus transforming what they claim to be one of the most beautiful and scenic water courses in the state into a dry barren and unattractive gorge. The company filed application last December, and the time for the protest expires within the next few days.

SPOKANE, WASH.—The Spokane Valley Power Company has petitioned to develop a site at the Bowl and Pitcher now held by the Spokane & Inland Empire System who give the reason for non-development that they are purchasing power from the Washington Water Power Company under a contract made prior to securing the power site and which does not expire until 1916, at an annual cost at \$76,000. The Spokane Valley Power Company contend that the transportation has no right to hold so valuable a power site without developing it, the opposing argument being that in view of the existing contract there would be no immediate advantage in prosecuting the development.

RENO, NEV.—W. H. Leffingwell, chief engineer for the Canyon Power Company, which has leased the power plant constructed by the government at the Lahonton dam, with Edson F. Adams and C. F. Cole, arrived from Bishop, recently, where several days were spent in going over the various districts with the view of securing information regarding mining districts that are now in the course of development and which can be regarded as future consumers of electric power. Both Mr. Adams and Mr. Cole are heavily interested in the power company. According to the plans of the company power lines will be extended from the Lahonton plant to Hazen and Lovelock, taking in various mining districts. It is intended to supply territory now dependent upon power other than electricity, for the development of mining interests and other industries. Mr. Leffingwell says; "The work of constructing the power lines will be undertaken at once. We expect to have practically everything in readiness by the 1st of

December. This will include not only the erection of lines, but the arrangements to enlarge the plant if that is found to be necessary. The Lahonton power plant was constructed by the government for the purpose of furnishing power and lighting facilities while the work of building the dam was in progress. A contract was also made with the town of Fallon for furnishing power to that city and at this time Fallon is the only private consumer of the enterprise. The Fallon contract will be taken over by the company.

EUREKA, UTAH.—Work is soon to started on the splendid new substation that the Utah Power Company will erect in this district. The new building, which will be about 50 by 70 ft. in size, will be erected on ground that the power company has purchased from the Chief Consolidated Mining Company, and the equipment that is now in the substation, near the Colorado mine, will be moved to the new location. Linemen are now at work changing the pole line and getting everything in readiness for bringing the power into the new substation. They are also reconstructing the "Knight" line into Tintic, removing the steel crossarms and replacing them with wooden crossarms. The power company has had trouble with this line and it is thought that the wooden crossarms will improve the service materially.

TRANSPORTATION.

BELLINGHAM, WASH.—It is reported practically all of the right-of-way for the Blaine-Lynden interurban railroad has been secured. The Blaine City council has granted the company a franchise over its streets and a like franchise has passed first reading before the Lynden city council.

VISALIA, CAL.—Work has been started on a three-mile extension of the Visalia electric railroad from Woodlake to the base of the foothills. The new construction will open up 1000 acres of land, a large portion of which is considered the equal of the best orange acreage in Tulare county.

PORTLAND, ORE.—After increasing the annual rental for use of the streets, the city commission put its approval on the 25 year franchise sought by the Portland & Oregon City Railway Company, for an interurban line through the east side to connect with a line being built from Oregon City to Portland.

SAN FRANCISCO, CAL.—The Daniel O'Day Company has been granted a permit to lay down tracks and operate cars with electricity by means of an overhead trolley system on the north side of Mariposa street from the east line of York street, to connect with the main line of the Ocean Shore Railroad, and to lay a temporary spur track on the west line of Hampshire street from a connection of the temporary spur track on Mariposa street.

SEATTLE, WASH.—An offer to the city of the Loyal Heights Railway System for the sum of \$80,057 has been received by the council. Harry Whitney Treat, owner of the railway agreed to accept utility bonds in payment. The price asked is said to represent the construction cost of the road including right-of-way and equipment. No valuation has been placed upon the franchise. It is proposed that the extension of the municipal system of division A connect with the Loyal Heights system.

SALT LAKE CITY, UTAH.—Electric service was inaugurated on the Salt Lake & Utah Railroad (the Orem Line) on Friday, July 24th, between Salt Lake City and Provo, a distance of 48½ miles. The road beds for this line were completed early in the season and steam service was installed pending the delivery and installation of the electrical equipment. The installation of this electrical equipment was made in record time, the apparatus for the two substations, outdoor switching stations, limbering up and testing out having been made in six weeks. The equipment which was furnished by the Westinghouse Electric & Manufacturing Company, was installed by the Westinghouse service department under the direction of M. R. Davis, district superintendent, with headquarters at Salt Lake City.

ALPHABETICAL INDEX TO ADVERTISERS

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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PER COPY, 25 CENTS

ELECTRIC DISTRIBUTION STANDARDS IN SAN DIEGO.

BY L. M. KLAUBER.

HISTORY OF ELECTRIC TRANSMISSION.

BY G. O. WILSON.

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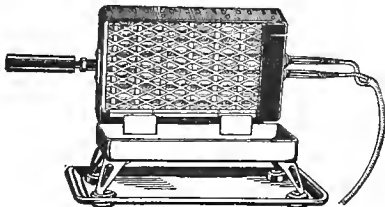
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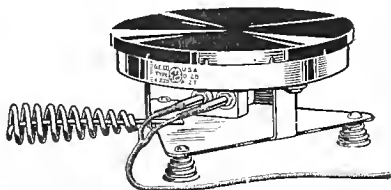
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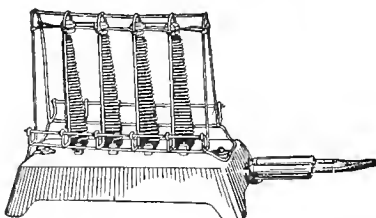
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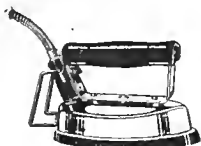
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VOLUME XXXIII

SAN FRANCISCO, AUGUST 15, 1914

NUMBER 7

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ELECTRIC DISTRIBUTION STANDARDS IN SAN DIEGO

BY L. M. KLAUBER.

(This initial number of a series of articles on the subject of standards for electric distribution introduces and explains the subject and shows the details of the line numbering system employed by the San Diego Consolidated Gas & Electric Company, for which Mr. Klauber is superintendent of the electric department.—The Editor.)

Introduction.

This series of articles consists of extracts and sketches derived from an "Electric Distribution System Pocket Book" issued by the San Diego Consolidated Gas & Electric Company for the use of the employees engaged in the construction or operation of its distribution system.

The San Diego Consolidated Gas & Electric Company, of which H. M. Byllesby & Company of Chicago are the engineers and managers, serves the city of San Diego and contiguous territory. This company, under the efficient management and energetic new business policy of the Chicago firm, has sustained a rapid growth during the past few years; its distribution system has grown from a small plant serving only the central part of San Diego, to one which covers thoroughly the southwestern part of San Diego county, and serves therein some twenty-nine towns and villages. The accompanying map shows the district covered by the electric distribution system.

The "Electric Distribution Pocket Book" was originally devised for the purpose of standardizing materials and methods of construction, particularly those details not covered in the 1911 report of the Committee on Overhead Line Construction of the National Electric Light Association, and other matters having local application only.

While this book has entailed considerable expense in the making, it is believed that it will prove a profitable investment in reducing operating expenses and enhancing economical and uniform construction. It forms a permanent method of advising construction

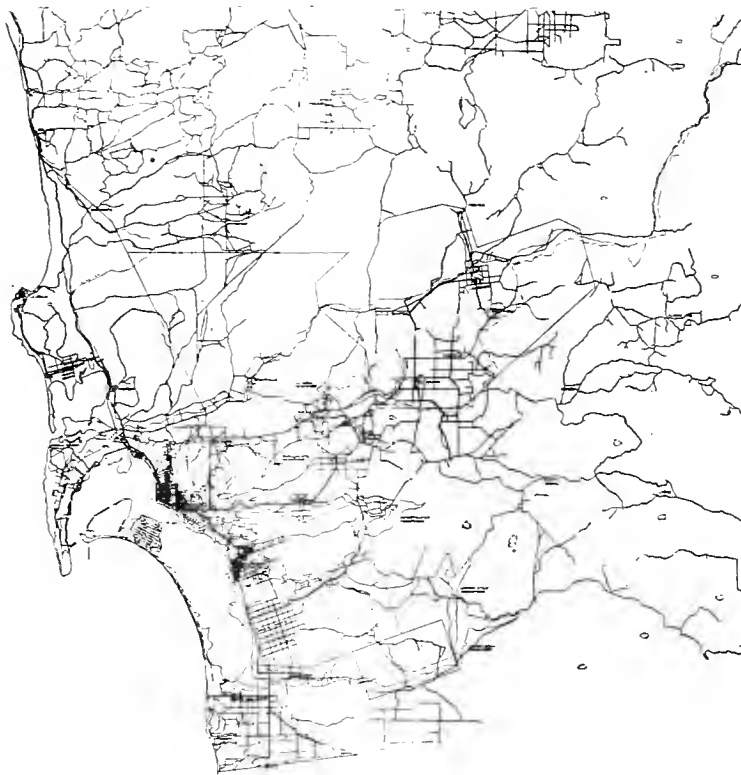
foremen of new systems, routine, or laws, as for instance, the method of numbering lines as outlined in Section A or the extracts from the California state law on Line Construction in D 93.1. The larger portion of the book has been in use for about eighteen months.

In this book it has been the intention to avoid all matters of theoretical interest only, and to consider practical construction details, and only those having definite bearing on the system of the San Diego Consolidated Gas & Electric Company. Necessarily but little matter contained in the book is new; it is merely the grouping from several sources, of material of value to the line foreman, inspectors, estimators and trouble men, to whom it is issued.

In the present article much matter of purely local interest will be omitted except for such notes as might be of assistance to other companies desiring to make similar records. Also at various points brief explanations will be inserted to cover methods which, while clear to those familiar with the distribution system of the San Diego company, might be obscure to those unacquainted

with it. Naturally in the preparation of this book for the employees of the company a certain familiarity with the local system and procedure was assumed.

A few words on the distribution systems employed may serve to define the scope of the pocket book. The San Diego Consolidated Gas & Electric Company has a single centrally situated steam plant, having a rated capacity of 8470 kw. (now being increased to 12470 kw.) Current is generated at 2300 volts, 3-phase, 60 cycles and is distributed throughout most of the city



Map of Distribution System of San Diego Cons. Gas & Electric Company.

at this voltage. The lighting feeders are run single-phase from the power plant and, for the maintenance of better voltage control, are segregated from the three-phase power feeders. The suburban districts are covered by three-phase 11,000 volt lines issuing from step up transformers located at the central station. Among these lines are installed small step down transformer banks reducing the voltage to 440 or 220-110 for isolated power or lighting consumers, or to 2300 volts for re-distribution to scattered districts. There are likewise the usual series arc and incandescent circuits for municipal lighting, a 500 volt direct current circuit for elevator service and a limited 220-110 volt direct current system in the central district. Distribution in the business district is underground.

General Description of the Book.

The book as issued to the employees is an I. P. loose-leaf binder, size 504, containing twelve celluloid tip index sheets and about 300 blue-printed pages, each $6\frac{3}{4} \times 3\frac{3}{4}$ in. A thin grade of blue print paper is used in order to get this many sheets in the book.

The treatment consists of the following points and divisions:

Index.

A Line Numbering.	G Motors.
B Pole Spacing.	H Meters.
C Standard Material	I Miscellaneous.
D Construction Details.	J Underground Construction.
E Transformers.	K Underground Maps.
F Street Lighting.	

Under index in the pocket book furnished the construction foreman there are filed sheets covering the indices of all the groups; these sheets are duplicated one at a time behind the individual tab sheets. Therefore, if it is desired to find the group in which a sheet falls it is customary to consult the general index at the book; if the group be known but not the sheet number, the index sheet immediately back to the tab sheet in each group may be more easily located.

The method of indexing used is a modified decimal system, permitting of indefinite expansion. The sheet number to which reference is made when mentioning these sheets in this article is that appearing in the lower right hand corner. The small number in the lower right hand corner is the number of the standard tracing which comprises the original, of which, of course, the sheet appearing in the book is only the central part. The number along the left hand edge is the correction number by which it can be quickly told which of two sheets is the later edition.

As new sheets are drawn or revisions completed they are forwarded to the owners of books with the understanding that they are to be inserted in numerical order, or if revisions, the old sheets are to be replaced.

The books as issued to the line foreman are not always complete; for instance, those foremen who never deal with the underground system or with meters do not receive the sections covering these matters.

Section A: Line Numbering.

This section is subdivided as follows:

- A 10 Numbers of Present Lines.*
- A 20 Method of Stencilling.
- A 30 Method of Numbering Lines.

- A 40 Method of Lettering Secondaries.
- A 50 Method of Numbering Transformers.
- A 60 Method of Numbering 11,000 Volt Switches.

A 10: Numbers of Present Lines. This division contains a tabulation on eight sheets of the numbers which have been assigned to the circuits in each district served by the company. These have been subdivided as to single-phase, three-phase, municipal arc and incandescent, 11,000 volt, 2300 volt lines feeding from high tension lines, and special circuits. These tabulations being of local interest only are not given here.

A 20: Method of Stencilling. The division contains general instructions as follows:

Corner Poles.—Stencil every wire on corner poles on that side of the cross arm which faces the street or alley.

Transformer Stations.—Stencil every wire on poles occupied by transformer stations. When installing a new station on an old pole, stencil every wire on that pole. Stencil on the transformer side of the cross arm. Stencil the transformer station number on the lowest cross arm to which the transformer is attached and on the side on which the transformer is hung.

Colors.—Stencil in black paint on yellow arms and white paint on green arms.

High Line.—Stencil the 11,000 volt lines at every switch pole and transposition pole. On long straight runs in the country stencil every 1500 feet.

Phase Letter.—11,000 volt lines should always be stenciled with phase letter, as for instance 75A, 75B, 75C. Omit phase letter when stencilling 2300 volt lines.

Size of Stencils.—Standard $2\frac{1}{2}$ in. stencils should be used for all stencilling on cross arms.

A 30: Method of Numbering Lines. This section was devised more for the use of estimators and those issuing work orders than for line foremen. Although the system seems complicated, it has now been in use over two years and has proved efficient. The numbering of new transformer stations or lines is solved almost automatically. The information on this subject contained in the Pocket Book follows:

Transformer Station and Circuit Numbering Systems.

Single phase 2300 volt circuits taken directly from the power plant buses take numbers 1 to 19 inclusive. Stations on such lines take numbers of which the first one or two figures indicate the circuit number, and the last two figures indicate the serial number of the station. Examples: Stations on circuit 13 are numbered 1301, 1302, etc. Stations on Circuit 7 are numbered 701, 702, etc.

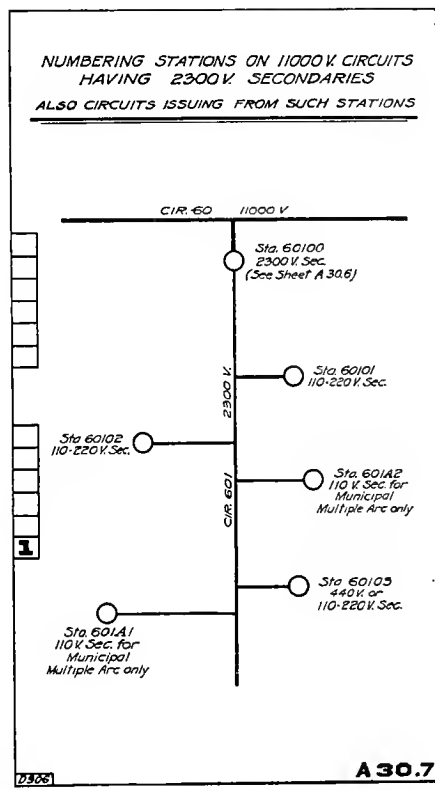
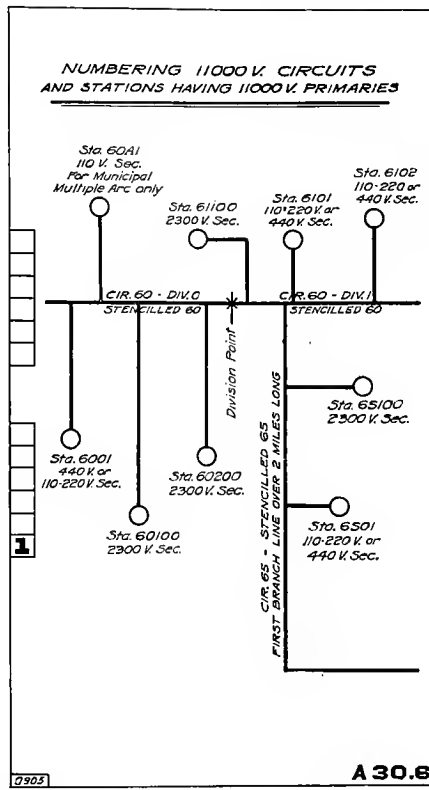
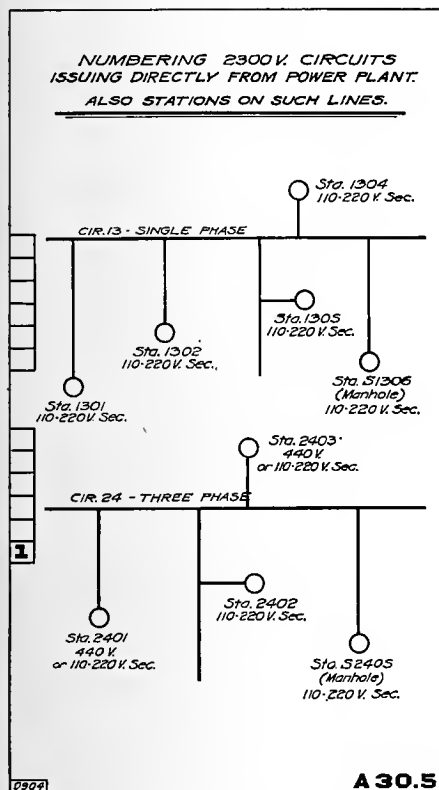
Three-phase 2300 volt circuits taken directly from the power plant buses take numbers 20 to 39 inclusive. Stations on such lines take numbers of which the first two figures indicate the circuit number, and the last two figures indicate the serial number of the station. Example: Stations on circuit 24 are numbered 2401, 2402, etc.

Series arc circuits issuing from the power plant are assigned numbers 40 to 59 inclusive. Transformer stations on such circuits are given four figure num-

bers, of which the first two numbers indicate the circuit number and the third number indicates the serial number of the station. The fourth number is invariably 0. The secondary line issuing from such a station takes the same number as the station, with the 0 omitted. Example: Stations on arc circuit 41 are numbered 4110, 4120, etc. The secondary line from station 4110 is stencilled 411.

11,000 volt circuits issuing directly from the power plant are given the numbers 60, 70, 80, 90, 100, 110, etc., as required. Each main line is divided into divisions, as for instance: Line 60, division 0; line 60,

two are chosen as in the case above. The third figure represents the serial number of the station and the last two figures are invariably zeros. Examples: Stations of this type on line 60, division 0, are numbered 60100, 60200, etc. Stations on line 60, division 1 (equivalent to line 61) are numbered 61100, 61200, etc. Stations on line 65 are numbered 65100, 65200, etc. The 2300 volt primary lines issuing from such stations take the numbers found by dropping the last two ciphers—as, primary line issuing from station 60100 is numbered 601, etc. 2300 to 110-220 volt stations on such primary lines have five figure numbers of



division 1, etc. The division number is not stencilled on the cross arm; it affects only the station numbers connected on the line. No line will have more than 5 divisions; that is, the last division in line 60 is division 4. Branch lines over two miles in length are given individual numbers of which the first figure is the same as that of the main line from which the branch is taken, and the second is the serial number of the branch. The lowest branch number is 5. Example: Branches from line 60 are numbered 65, 66, etc. Branches less than two miles in length take the same number as the main line.

Stations on 11,000 volt lines stepping down to 440 or 110-220 volt secondaries have four figure numbers, of which the first two indicate the number of the 11,000 volt circuit and the last two the serial number of the station. Examples: Stations on line 60, division 0 are numbered 6001, 6002, etc. Stations on line 60, division 1 are numbered 6101, 6102, etc. Stations on branch line 65 are numbered 6501, 6502, etc. It will be noted that as far as station numbering is concerned line 60, division 1 may really be considered line 61, etc.

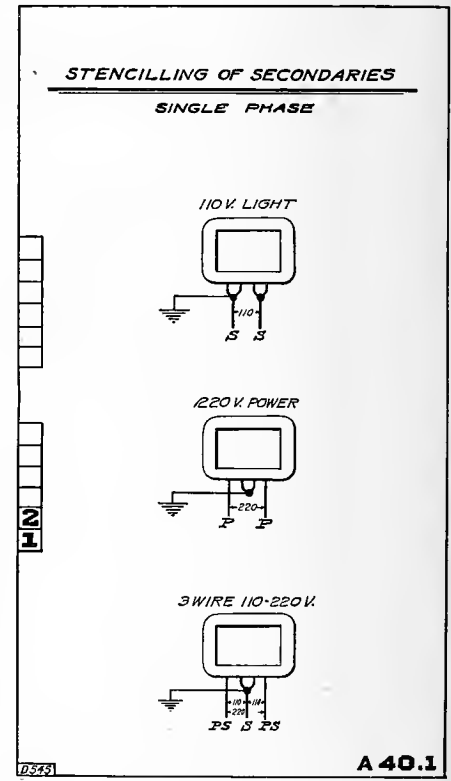
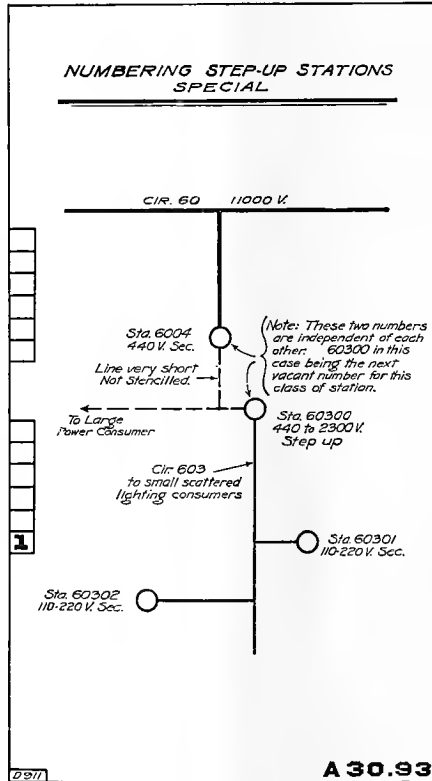
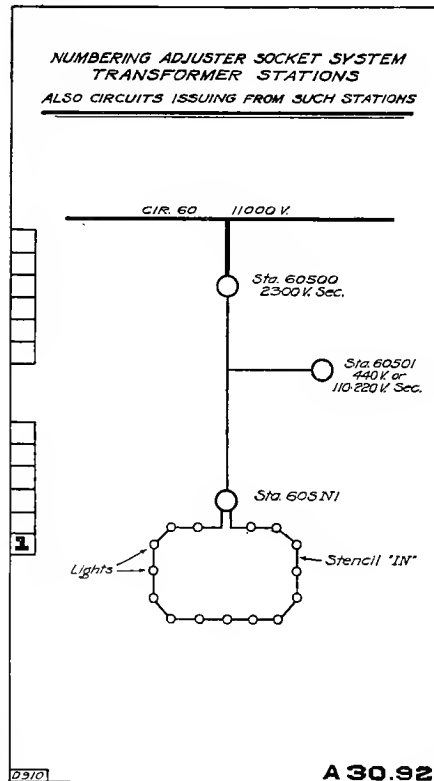
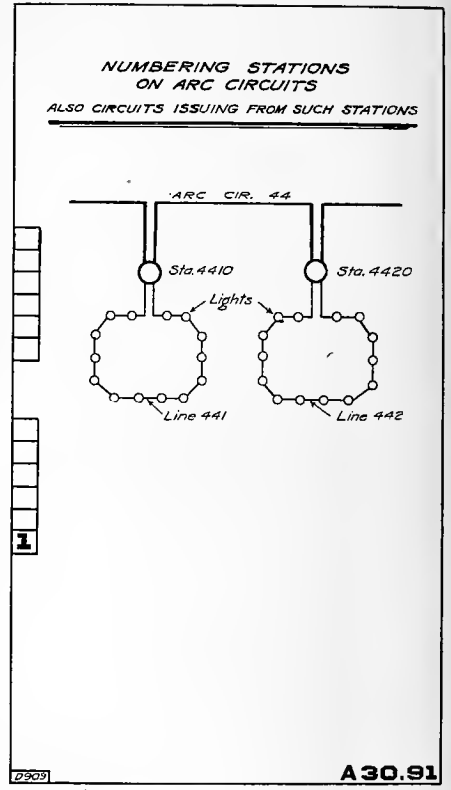
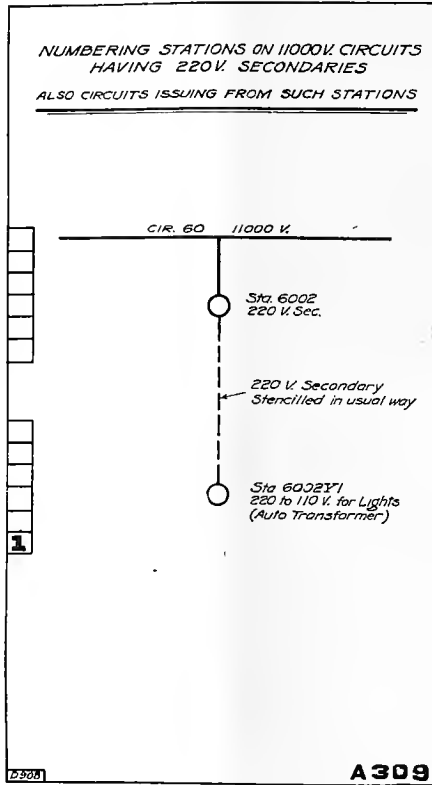
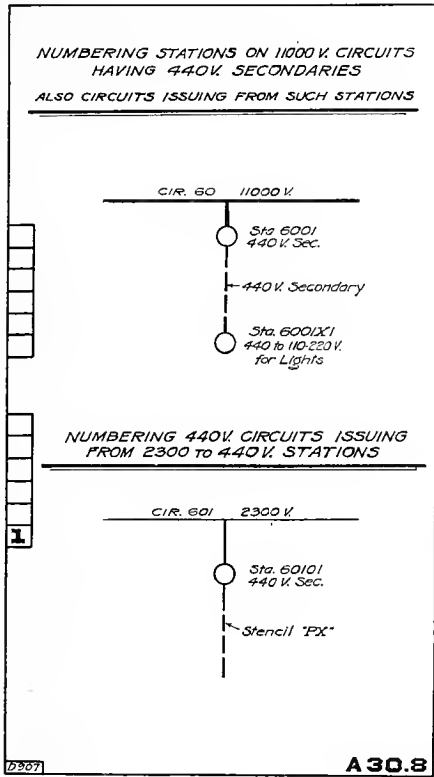
Stations on 11,000 volt lines stepping down to 2300 volts have five figure numbers of which the first

which the first three figures give the circuit number and the last two figures the serial number of the station. Example: Stations on line 601 are numbered 60101, 60102, etc.

Municipal multiple arc stations such as are used in scattered suburban districts carry municipal arcs exclusively due to the fact that they are cut out on the primary side during the day time by means of a primary switch wire. Such stations take numbers in which appears the letter "A." The numbers preceding "A" give the line number and the numbers following "A" the serial number of the station. Examples: Multiple arc stations on line 601 are numbered 601A1, 601A2, . . . 601A10, 601A11, etc. If the arc were connected to a 11000-110 volt station on line 65 the station would be 65A1.

2300 volt primary switch wires are stencilled "L." Secondary wires issuing from multiple arc stations are stencilled "SL." Where two or more primary switch wires are necessary in the same town owing to the desirability of balancing the arc load on a three-phase system, they are stencilled L1, L2, etc.

In adjuster socket systems for series incandescents the station takes a number in which appears the letter "N." Examples: Adjuster socket stations on line

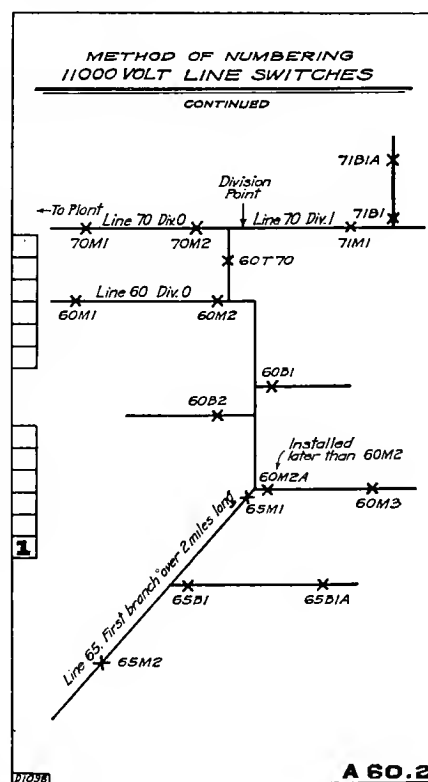
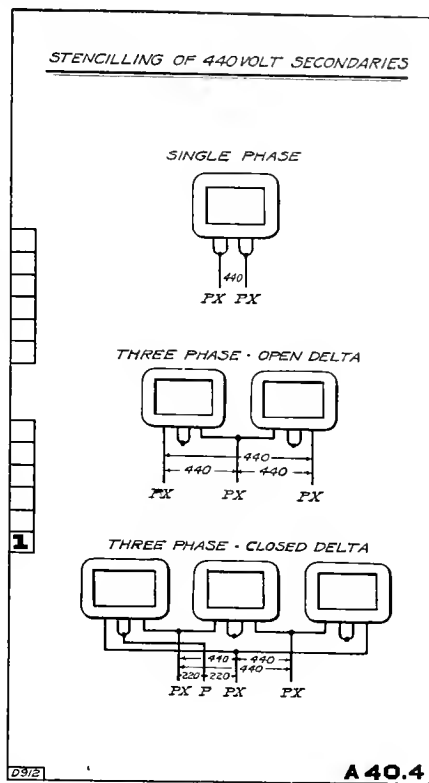


601 are numbered 601N1, 601N2, etc. Secondaries from such stations are stencilled "IN."

Stations having low voltage primaries. In the farming districts it is sometimes necessary to step down from 440 volts to 110 for lights and even occasionally (by means of an auto transformer) from 220 to 110. Such stations are given numbers containing the letter "X" (or "Y" in the case of 220 volt primaries) in which the numbers preceding the "X" indicate the station from which the 440 (or 220) originates

and the numbers following indicate the serial number of the station. Examples: 440 volt stations on 440 volt line issuing from station 6001 are numbered 6001X1, 6001X2, etc.

Step up stations are occasionally used where there is a large power consumer for whom current is stepped down from 11,000 to 440 or 220 and where there is also a small scattered lighting load necessitating a 2300 volt distribution system. In this case a small station is installed stepping up from 220 or 440 to



2200 Volt Motors.—In the case of 2200 volt motors

where no transformers are required a station number is used to cover the motor installation, as for instance, M2516 would represent service to a 2200 volt motor on circuit 25. Where two or more 2200 volt motors are installed at the same place only one station number is used as this represents a single service. Where an 11,000 to 2200 volt station is installed to give service to a 2200 volt motor from an 11,000 volt line, give the step down station a characteristic number ending in two ciphers (as for instance 65,500) and consider the motor as the first line station (as for instance M 65,501).

Transformers.—Transformers are numbered consecutively without regard to size or type. However the following prefixes are used to denote general groups into which transformers fall:

N—Adjuster socket system transformers.

H—11,000 volt primary.

L—Series arc transformers, type SL.

P—2200 volt primary, 9 to 1 ratio only.

S—Subway.

X—440 volt primary.

Transformers without prefix letters are transformers having 2080, 2200 or 2400 volt primaries, with or without taps, and the main ratio is 10 to 1.

11,000 volt line switches are given 4 or 5 figure numbers of which the first two figures give the line number. Following this there is a letter giving the class of switch (M=main line; B=branch line; T=tie), after which is placed the serial number of the switch, numbering out toward the end of the line. If a branch line is long enough (2 miles, see Sheet A30.1) to receive a separate number, any switch in this branch line is considered a main line switch. If there are two or more switches on the same branch less than 2 miles long, the second switch receives a suffix letter, as for instance: First switch, 65B1, second switch, 65B1A. If a new switch is installed between two old switches in a main line the new switch is given a suffix letter, but the numbers of the original switches are not changed. For instance, if a new switch is installed between 60M2 and 60M3, the new switch is called 60M2A.

The accompanying cuts show graphical examples of these numbering systems to illustrate more clearly the methods used.

[To be continued.]

The international electrical exposition which Spain planned to hold at Barcelona next year has been postponed to 1917 and will be broadened in its scope.

Under-water talk between forts is being provided by the U. S. Signal Corps, which is laying a submarine cable in Puget Sound to establish communication between the various fortifications that guard the approach to Seattle. Three forts are to be connected so that there will be three legs to the submarine telephone system. Seventeen miles of 20-pair No. 19 B. & S. gauge paper insulated submarine telephone cable will be required for this work. The Western Electric Company has shipped it in seventeen lengths of one mile each, one mile of cable to a reel and two reels to a flat car.

HISTORY OF ELECTRIC TRANSMISSION

BY G. O. WILSON.

[Concluded.]

(In this concluding installment the author marks the milestones which have defined the history of high tension transmission during the past fourteen years.—The Editor.)

We have thus followed in considerable detail the history of the development of power transmission throughout the world, from its infancy to the year 1900. To describe in similar detail the enormous growth of the industry from that year to the present day would be a work far beyond the scope of this paper. In order, however, to make this history in some measure complete, an effort will be made to pick out the milestones of progress during this time.

In England, the concentrated nature of the power market, together with the well distributed available water supplies and coal fields, has served to hold the voltage down, in spite of the fact that governmental restrictions were removed in 1902, and many power houses of large capacity have been developed since. In 1912 a 100,000 volt Thury system was installed for the purpose of transmitting relatively long distances from the coal fields, but with this exception all the large plants in England still continue to operate at voltages ranging from 6000 to 20,000.

In the rest of the world, the most notable characteristic of the development of the industry has been the growth of great networks, fed by a number of stations, and serving large areas with power. In this growth the United States has been the leader, and with few exceptions the first steps toward longer lines, higher voltages, and greater connected power in the networks have been in California. We have today, in the Pacific Gas & Electric Company, together with the Great Western Power Company, to which the former concern can connect its lines in case of emergency, the greatest network in the world, with a total available power supply from all hydroelectric and steam plants, of about 200,000 kw. And we also have, in the 250 mile, 150,000 volt line from Big Creek to Los Angeles, the longest line and the highest voltage in the world, two of the power houses of this great project having been started early in 1914, with a capacity of 35,000 kw. each.

The rapid rise in the commercial limit of transmission voltage in the decade from 1890 to 1900 was checked at about that time by the development of the art of insulator building. The first step above the 40,000 volts at Provo was made by the Missouri River Power Company in 1902, when they placed their double pole line to Butte in commission at 50,000 volts. This line was only 65 miles long, the record for distance at this time being held by the Bay Counties Power Company's 140 mile line from the Yuba River to Oakland, California, operated at 40,000 volts. The next step was to 60,000 volts, on the 100 mile line at Guanojuato, Mexico, completed in 1904; and later in the same year, 66,000 volts was used on the longest line in the world, 232 miles from De Sabla to Sausalito. This figure was not raised until the end of 1906, when the 75 mile line from Muskegon to Grand Rapids, Michigan, was successfully placed in commission at 72,000 volts. In the latter part of 1908 the line from Croton Dam to Grand Rapids was started at 110,000



Big Creek Power House of Pacific Light & Power Co.

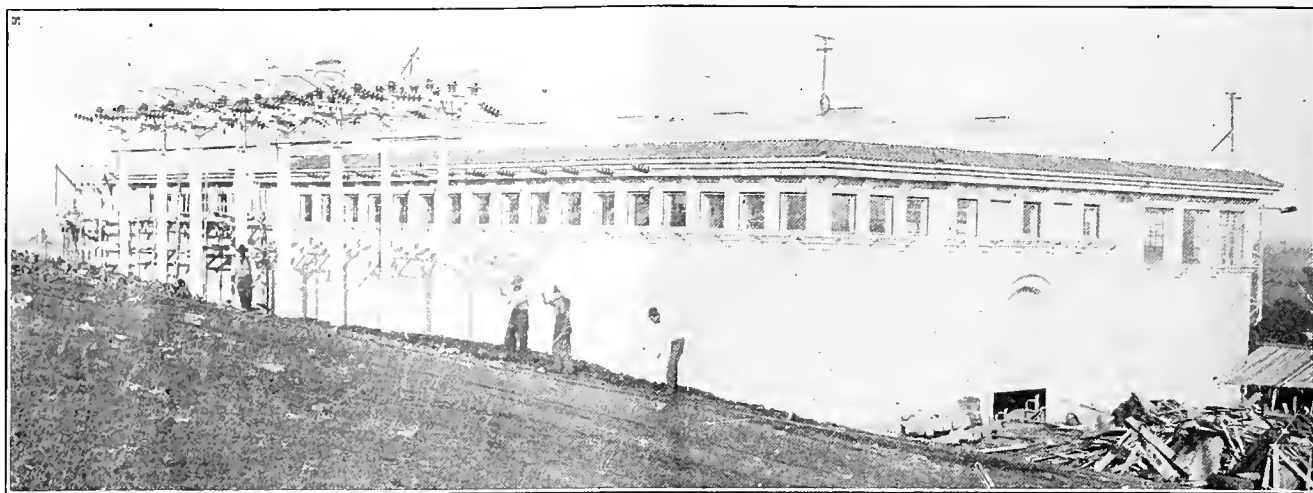
volts, and early in 1912 the 225 mile line from Au Sable to Flint, Michigan, again claimed the record with 140,000 volts.

This progress of the maximum voltage in America has been far in advance of European practice. The first 30,000 volt line on the continent was from Hochfeld to Clattfelden, in Germany, started in 1901. It was not until 1905 that this pressure was exceeded by the 112 mile line from Moutiers to Lyons, France, which was operated at a voltage of 57,600. This was, however, a direct current line; the highest alternating voltage in Europe at this time was on the line from Cellina to Venice, where 36,000 volts was used. In the latter part of the following year a 40,000 volt line was placed in operation between Cromo and Nembro, in Italy; and before the end of 1907 there were two 50,000 volt lines, one in Germany, and the other in Norway. It was not until 1910 that this pressure was exceeded, the 150 mile line from Molinar to Madrid being operated at a pressure of 70,000 volts early in this year. Before the end of the same year, the 112 mile line from Abruzzi to Naples was placed in commission at 88,000 volts, and the Lauchkammer Steel Company in Germany began transmitting 20,000 kw. 35 miles from their coal fields at 110,000 volts. This line has remained the highest voltage in Europe to the present.

In the extent and capacity of networks, the leadership of the United States over European practice has not been so marked, although the Niagara system, as well as the Pacific Gas & Electric network on the Pacific Coast, are far greater than anything yet constructed in Europe. At Niagara, the capacity of the Niagara Falls Power Company has been increased to 105,000 h.p. thus utilizing the full capacity of the tunnel; and the capacity of the plant in the gorge was increased to 33,000 h.p. in 1905, and to 56,000 h.p. in 1909. The Canadian plant of the Ontario Power Company had 58,000 h.p. installed in 1909, and has at present a capacity of over 100,000 h.p. feeding two of the longest lines east of the Rockies—one 160 miles to

Syracuse, and the other transmitting 40,000 kw. 90 miles to Ontario at 110,000 volts. On the Pacific Coast, in addition to the great network of the Pacific Gas & Electric Company and the Great Western Power Company, mentioned above, there is still another important line in Central California, that of the Sierra & San Francisco Power Company, transmitting 20,000 kw. 134 miles from the Stanislaus River to San Francisco. In Southern California three power companies have built up a great network centering at Los Angeles, having an aggregate capacity of over 50,000 kw., not including the great new plant at Big Creek, or the proposed aqueduct system. The Southern Sierras Power Company also is transmitting power at 140,000 volts, 238 miles from Bishop Creek to San Bernardino. Northern California also has a large network, the total capacity of the Northern California Power Company being 47,000 h.p. In the Northwest, the Snoqualamie Falls power house has a capacity of 20,000 kw., this power being supplied to Seattle, Tacoma and Everett, in Washington. These cities also receive 15,000 kw. from the Puyallup River. The Washington Water Power Company transmits 22,000 kw. 100 miles from Little Falls to Wallace in Idaho. In the Rocky Mountain district, the greatest network is that of the Great Falls Power Company, in Montana, having a total capacity of 72,000 kw., and a maximum distance of transmission of 150 miles. The original Telluride Power Company in Utah has a 30,000 kw. network centering at Salt Lake, and the Central Colorado Power Company has a 15,000 kw. network centering at Denver, this last being located at the greatest elevation of any large power system in the world, and crossing the continental divide three times.

In the Eastern part of the United States, in addition to the great Niagara plant, many large networks have grown up. At Keokuk, Iowa, is the largest plant in the world with an installed capacity of 150,000 h.p. 90,000 kw. of which is transmitted 140 miles to St. Louis. The Southern Power Company, with 150 miles



Cordelia Substation of Pacific Gas & Electric Co.

of lines in the great cotton belt in North and South Carolina, has a total capacity of 75,000 kw. in a 110,000 volt network. A southern network of almost equal size is that of the Central Georgia Power Company, having a capacity of 60,000 kw. and a maximum distance of transmission of 170 miles, also at 110,000 volts.

In Canada, in addition to the great Canadian Niagara power house, the largest power scheme is that at Shawinigan Falls, transmitting 40,000 kw. 85 miles to Montreal at 100,000 volts. In Mexico, the 171 mile, 60,000 volt line transmitting 30,000 kw. from Mecasa to the City of Mexico and the El Oro mines is the greatest power project of the present day. In South America, the extremely humid character of the atmosphere has kept the voltage, and consequently the length of transmissions considerably lower than in the United States or Europe. A 20,000 h.p. plant transmitting 21 miles at 24,000 volts was placed in operation in Brazil in 1901. In 1908, 9000 kw. was installed on the Piabanka River and transmitted 50 miles at 44,000 volts. In the following year this plant was enlarged to a capacity of 30,000 kw., and the voltage of transmission was increased to 88,000, thus making it the greatest plant in South America, which position it still holds.

In Europe, Italy and France have led the way in the building of great networks. In 1906 Italy had the greatest system in Europe, 83,000 h.p. being connected

to the lines supplying Genoa. In the same year the direct current supply to Lyons mentioned above, was supplemented with a 115 mile alternating current network having a total capacity of 31,000 h.p. which was increased to 45,000 h.p. in 1910. The years following 1906 saw the growth of the greatest system in Europe in Southern France; by 1909 this network contained 600 miles of lines, connected to 19 different stations of an aggregate capacity of 91,800 kw. This remains the greatest network in Europe, although several systems having capacities from 20,000 to 50,000 kw. have grown up in Italy, Norway, Spain and Switzerland.

The gas industry in the United States represents a capitalization of more than a billion dollars and an annual value of output close to two million dollars. Of the 212,391,168,000 cu. ft. of gas made in 1912, 42.2 per cent was coal gas and 57.8 per cent oil and water gas.

An oil motor ship of 8000 tons and 6000 h.p. has been laid down in the new yard of Barclay Curle & Company at Scotstoun West for the Russian East Asiatic Company, of St. Petersburg who are also considering designs for a motor ship having engines of 36,000 h.p. The St. Petersburg vessel will be twin screw, have a speed of 16 knots, and will be engaged in her owners' service between Libau and New York.

HYDROELECTRIC PLANTS OF JAPAN.

	Location.	Capital, yen.	Trans. V.	Head.	Turbines.	Generators.
Tokyo Electric Light Co.	Tokyo	50,000,000	57,000			
Station No. 1.				345 ft.	6-5600 h.p. Escher Wyss	6-3900 k.v.a. Siemens.
Station No. 2.				375 ft.	6-12,500 h.p. Escher Wyss	6-7700 k.v.a. A. E. G.
Katsuragawa Electric Power Company.	Katsuragawa, 50 miles west of Tokyo.	8,000,000	77,000	473 ft.	4-10,000 h.p. Voith	4-7000 k.v.a. G. E.
Kinugawa Hydro-Electric Company.	Kinugawa, near Tokyo.	13,500,000	66,000	1050 ft.	6-12,500 h.p. Escher Wyss	6-8700 k.v.a. A. E. G.
Inawashiro H. E. P. Co.	Lake Inawashiro, 150 miles north of Tokyo	21,000,000	115,000		6-11,250 h.p. Voith	6-7775 k.v.a. Dick Kerr
Sagami H. E. P. Co.	Sagami River, near Tokyo.	5,000,000	66,000			
Station No. 1.				137 ft.	3-3780 h.p. Bovings.	3-2500 k.v.a. A. S. E.
Station No. 2.				83 ft.	3-2350 h.p. Bovings.	3-1500 k.v.a. A. S. E.
Fuji Gas Cotton Spinning Company.	Near Hakone.		66,000	300 ft.	4-3250 h.p. Escher Wyss	4-2200 k.v.a. Shibaura
Tone Hatsuden Kaisha.	Tone River, 60 miles north of Tokyo.		66,000	450 ft.	3-9200 h.p. Voith	3-6000 k.v.a. G. E.
Ujigawa H. E. P. Co.	Near Kioto.	12,500,000	32,000	205 ft.	6-8000 h.p. Voith	6-5400 k.v.a. A. E. G.
Kyushu E. H. P. Co.	Kyushu	11,500,000	66,000	235 ft.	5-5600 h.p. Voith	5-3750 k.v.a. G. E.
Nagoya Electric Light Company.	Nagoya	16,000,000			10,950 h.p.	
Oji Paper Mill Company.	Hokkaido				13,200 h.p.	

EFFICIENT POWER PLANT MANAGEMENT

CORRESPONDENCE FILING CLASSIFICATIONS.

(Through the courtesy of the Pacific Power & Light Company of Portland, Oregon, their system for filing correspondence is here presented. It is believed to be one of the first practical adaptations of the Dewey decimal system of indexing that has been devised for the use of public service corporations. The entire system will be printed in full in succeeding issues, the only change made being the re-arrangement of the preliminary instructions for its use.—The Editor.)

General Description.

This classification is a logical arrangement of the subjects covered by the correspondence of the departments of the Pacific Power & Light Company. In the groups, no recognition has been made of departments, of geographical location or of job numbers.

Each subject is given a number, and each letter relating to that subject is marked and filed under that number. The numbering is an adaptation of the Dewey Decimal System, and permits of indefinite extension. This is an important feature, and one of the most valuable of the system. It is obviously impossible to develop a system so complete but that some addition, extension or subdivision will later be desired.

The classification has been made so comprehensive that all departments may make use of it.

Unless desired otherwise, the letters of all departments may be intermixed with those of other departments, and filed in the same folders. Provision has been made, however, so that any department wishing to isolate its correspondence from all others may do so by prefixing a letter to the regular file number. Each department of the company has therefore been assigned a designating letter, as follows:

G—General Matters.	P—Purchasing Department.
X—Executive Department.	E—Engineering & Construction Department
L—Legal.	T—Operating Department.
R—Right-of-Way & Property Department.	N—New Business Department.
F—Financial Department.	
A—Accounting Department.	

Any department may avail itself of separate files at any time by using its departmental prefix.

Rules for Filing.

(1) No letters or copies will be received by the filing clerk unless clearly marked in upper right-hand corner with the file number. The original and all copies shall be similarly marked.

(2) Each department shall arrange for the classification and marking of its incoming and outgoing correspondence. It is recommended that this be done by the stenographers receiving the dictation.

(3) The responsibility for correct and accurate classification lies with each department. The filing clerk will file all letters as numbered without questioning the correctness of the number.

(4) In asking for a letter from the files, the file

number or numbers should first be determined by the department making the request. The individual who numbered the letters is best qualified to say in what file to look for the sheet in question. It is, therefore, recommended that stenographers be sent in quest of letters from the files, as such procedure will tend to increase the care with which they assign the file numbers in the first place.

The filing clerk should not be called upon to perform this function, but will assist in every way possible when a department has trouble in locating its correspondence. As an aid in this work, a complete alphabetical card index will be maintained up to date at all times in the filing room.

(5) When a letter is wanted, the folder containing the letter, along with others on the same subject, will be handed intact to the department.

A special pink card will be inserted in the filing cabinet in lieu of the folder removed, and on this pink card will be noted the name of the individual receiving the folder and the date it was given out. Upon return of the folder, the pink card will be removed and the date of return placed opposite the individual's name.

(6) ADDITIONS TO THE CLASSIFICATION will from time to time be found desirable and necessary. In all such instances, the departments must take up this matter of assignment of new numbers with the one in charge of this work. It is imperative that no additions be made by any persons except as herein authorized.

(7) The stenographers of each department are requested to have the correspondence of the previous day numbered and ready for collection by 10:00 a. m. All letters will be collected by the filing clerk. No attempt should be made to deliver them to the filing room.

Instruction for Use.

This classification should first be studied carefully and thoroughly so as to obviate errors that generally come up when a system of this kind is first used. No recognition has been made of departments, but recognition has been made of divisions of subjects; that is, all matters pertaining to electricity, electrical equipment and the utilization of electricity are grouped together and this system is followed out with regard to subjects pertaining to gas, water and railways. If one wishes to find the file number for, say, generators, the first place to look would be under the 300 series, not "Material and Supplies" under the 700 series, as that deals with only the miscellaneous material and supplies common with electricity, gas, water or railways, and not specific items.

When one first sees a classification of this kind, he generally throws his hands up in horror after realizing the wide scope of the system as to the number of files, but the one thing to be remembered is that the efficiency of a filing system is improved when "miscellaneous" files are split up into "specific" files, and all repetition of file subjects is eliminated.

A revision of the files is not made, of course, on account of just a few changes. When any new topic or subject arises, it is always closely related to some existing head or sub-division of a heading, and combining it with the nearest head by adding a decimal place makes abundant room for the new comer. The system is thus capable of unlimited expansion and can never break down for lack of room for growth. Remember, though, that no suggested number should be used, or will be allowed, until that particular number is accepted and incorporated in the filing classification and you are notified of such incorporation in the files.

Be careful about the use of file numbers. Whenever a mistake is found in the numbering of letters that come to this office, it will be corrected and you will be advised of the change, and the reasons therefor. If you have doubts as to what file to use on certain letters, why do the best you can and then take the matter up with this office. Do not hesitate at any time to write for information on anything pertaining to the filing of letters or about the file classification itself. It has been in use in Portland for over eight months and only now is it being really understood and appreciated, which appreciation comes, of course, simply because the proper knowledge is being gained about such a filing system.

In starting the use of the system the stenographer receiving the dictation will select the proper file number and place it in the upper right hand corner of the original and all duplicate copies. Only one subject should be covered in any letter. If you cover two or more subjects, it is evident that the letter can be filed under but one, and you will have placed yourself in a position where you may be subject to considerable delay in receiving your copy when you desire it at a later date.

All persons are urged to study the classification. An intimate acquaintance with the classification is necessary for stenographers and filing clerks. Great benefit will result if persons who dictate letters will sufficiently acquaint themselves with the groups and subdivisions of the classification so that when dictating they will stop their letter when one of the subjects has been covered, and make the next subject the matter for another letter.

The duplication of subjects is one of the greatest difficulties experienced in the operation of the system and more familiarity with the natural groupings of the classification is, therefore, urged so this trouble may be obviated.

Persons dictating should give a title to each letter, which indicates the essence of the subject matter. This will guide the stenographer in selecting the proper file number. When you are dictating, a verbal reference should be made to any file number which may appear on a letter which is being answered. This will assist in sending the letter and the answer to the same folder.

Main Divisions.

- 000—General.
- 100—Land and Structures.
- 200—Rates—Statistics—Contracts—Advertising.
- 300—Electricity.
- 400—Gas.

500—Water.

600—Railways and Highways.

700—Materials and Supplies.

000—General.

010—General—Inventories—Valuations—Reports.

Note:—See Files 052.4, 121, 131, 210, 310, 410, and 610.)

020—Organization.

021—Organization Charts—Subordination of Departments—General Instructions.

025—Branch and Local Organizations.

030—Directors—Stockholders—Officers—Employees.

031—Directors—Stockholders.

031.1—Meetings of Directors or Stockholders.

032—Officers—Employees.

032.1—Meetings of Officers and Employees.

032.2—Applications for Positions—Introductions—Letters of Recommendation—Help Wanted.

032.21—Heads of Departments—Officials.

032.22—Superintendents and Foremen.

032.23—Engineers (Civil, Mechanical and Electrical.)

032.24—Linemen and Wiremen.

032.25—Clerks—Accountants—Stenographers—Timekeepers—Checkers.

032.26—Salesmen and Solicitors.

032.29—Miscellaneous.

032.3—Vacations—Itineraries while away from Headquarters—Trips.

032.4—Engagements & Meetings by Appointment.

032.5—Confidential or Private Matters Relating to Officers or Employees and Others.

033—Appointments—Resignations—Employment & Discharge—Rates of Pay—Hours of Work.

033.01—Employment—Appointment.

033.02—Discharge.

033.03—Rates of Pay.

033.04—Resignations.

033.05—Transfers of Employees—Advancement.

033.2—Employment Agencies.

034—Grievances—Labor Organizations—Strikes.

040—Public and Governmental Relations.

040.1—Regulations of Public Utilities—Political.

040.01—Laws—Federal—State—Municipal.

040.001—Enforcement Of.

040.0011—Police and Detective Service—Protection of Property.

040.0012—Arrests, Prosecutions, Convictions.

040.011—Federal Bills and Acts.

040.012—State Bills and Acts.

040.013—Municipal Bills and Acts.

040.014—County Bills and Acts.

040.2—Names and Other Information City, County and State Officials.

041—Relations with Federal Government.

042—Relations with State Government.

042.1—The Public Service Commission of Washington.

042.2—The Railroad Commission of Oregon.

043—Relations with County Government.

044—Relations with Municipal Government.

044.1—Municipal Competition or Ownership.

045—Relations with the Public.

045.1—Clubs—Societies—Associations.

045.11—Dues—Donations—Subscriptions.

045.2—Speeches—Published Articles—Magazines—Periodicals, Etc.

- 045.21—Subscriptions.
- 045.22—Newspaper Articles—Clippings.
- 045.3—Relations with Contractors, Manufacturers and Merchants.
- 045.4—Agriculture and Agriculture Products.
 - 045.41—Crops, Crop Reports and Prospects.
 - 045.42—Grain and Grain Products.
 - 045.43—Fruits and Vegetables.
 - 045.431—Apples.
 - 045.432—Other Trees and Fruits.
 - 045.433—Berries.
- 045.5—Forestry—Timber and Lumber Business.
- 045.6—Animals and Animal Products.
 - 045.61—Live Stock.
 - 045.62—Poultry, Game and Fish.
 - 045.63—Dairies—Dairying.
- 045.7—Farm Lands, Investigations—Purchase and Sale of, Etc.
 - 045.71—Experimental Farms—Farming In-scriptions, Etc.
- 046—Matters Relating to Other Companies.
 - 046.1—General Relations with Other Companies.
 - 046.2—Purchase or Sale of Properties.
- 047—Competition (Other than Municipal.)
 - 047.1—Electric.
 - 047.2—Water.
 - 047.3—Gas.
 - 047.4—Irrigation (Whether Gravity or Power.)
- 048—Accidents.
 - 048.01—Charts Showing Location Of.
 - 048.02—Employers' and Employees' Liabil-ity.
 - 048.03—Coroners' Inquests.
 - 048.04—Precautions Taken to Avert Acci-dents—Investigations.
 - 048.1—Train and Railway Accidents.
 - 048.2—Personal Injuries, Accidents and Sickness.
 - 048.21—Stretchers.
 - 048.22—Medicines and Cases.
 - 048.23—Surgeons and Physicians.
 - 048.231—First Aid to the Injured.
 - 048.24—Hospitals, Relationship With.
 - 048.25—Attempts to Defraud Company.
 - 048.3—Claims and Damages.
 - 048.31—Personal Claims and Suits.
 - 048.32—Property Claims and Suits.
 - 048.4—Payments for Damages (Personal or Prop-erty.)
- 050—Financial—Accounting.
 - 051—Financial.
 - 051.1—Stocks.
 - 051.11—Transfer of and Registrar.
 - 051.12—Dividends.
 - 051.13—Common Stock.
 - 051.14—Preferred Stock.
 - 051.15—Voting Trust Certificates.
 - 051.16—Escrow Agreements.
 - 051.17—Reports of Sales.
 - 051.19—Stock of Other Companies.
 - 051.2—Bonds.
 - 051.21—Bond Coupons.
 - 051.22—Interest on Bonds.
 - 051.23—Redemption of Bonds.
 - 051.24—Sinking Funds.
 - 051.25—Mortgages.
 - 051.26—Interim Agreements.
 - 051.27—Engineers' Certificates.
 - 051.28—Treasury Bonds.
 - 051.3—Banks & Banking.
 - 051.03—Forgeries—Defalcations.
 - 051.31—Loans.
 - 051.32—Deposits—General Funds.
 - 051.33—Checks—Drafts.
 - (Note:—For remittances, see 052.201.)
 - 051.34—Withdrawals—Overdrafts.
 - 051.35—Local Office Funds.
 - 051.36—Balances & Statements.
 - 051.4—Insurance.
 - 051.41—Fire Insurance.
 - 051.42—Accident Insurance.
 - 051.43—Fidelity Bonds.
 - 051.44—Employers' Liability Insurance.
 - 051.45—Workmen's Compensation.
 - 051.5—Notes.
 - 051.51—Promissory Notes.
 - 051.52—Warrants (City and Other.)
 - 052—Accounting.
 - 052.01—Auditing.
 - 052.011—Auditor's Reports.
 - 052.03—Improvement Requisitions.
 - 052.04—Work Orders.
 - 052.041—Transmittal — Approval — Cancellation.
 - 052.042—Details — Discrepancies — Further Information.
 - 052.05—Maintenance Orders.
 - (File under Specific Equipment or thing involved, if possible.)
 - 052.06—Production Orders.
 - 052.1—Accounts Receivable.
 - 052.101—Statement of Cash Receipts.
 - 052.11—Delinquent Accounts.
 - 052.12—Railway Claims and Refunds on.
 - 052.13—Accounts with Electric Customers.
 - 052.131—Discounts, Rebates, Etc.
 - Discount Periods.
 - 052.132—Amount of Bill—Proper Charges—Disputed Bills—Final Statements.
 - 052.133—Computation of Bills—Instructions on Billing Customers.
 - 052.134—Collection of Accounts not Delin-quent.
 - 052.135—Manner of Handling Accounts.
 - (See File 052.7.)
 - 052.14—Accounts with Gas Customers.
 - 052.141—Discounts, Rebates, Etc.
 - *Discount Periods.
 - 052.142—Amount of Bill—Proper Charges—Disputed Bills—Final Statements.
 - 052.143—Computation of Bills—Instructions on Billing Customers.
 - 052.144—Collection of Accounts not Delin-quent.
 - 052.145—Manner of Handling Accounts.
 - (See File 052.7.)
 - 052.15—Accounts with Water Customers.
 - 052.151—Discounts, Rebates, Etc.—Discount Periods.
 - 052.152—Amount of Bill—Proper Charges—Disputed Bills—Final Settlements.
 - 052.153—Computation of Bills—Instructions on Billing Customers.
 - 052.154—Collection of Accounts not Delin-quent.
 - 052.155—Manner of Handling Accounts.
 - (See File 052.7.)
 - 052.16—Accounts with Railway Customers.
 - 052.17—Merchandise and Sales Accounts.
 - 052.171—Conditions of Sales—Agreements.
 - 052.172—Collections—Amounts Due, Etc.
 - 052.173—Amount of Bills—Proper Charges.
 - 052.174—Discounts, Rebates, Etc.
 - 052.10—Other Accounts Receivable.
 - 052.191—Rebates on Material and Goods Received or Purchased.

052.2—Accounts Payable.

052.201—Remittances.

052.21—Labor Accounts.

052.211—Cash Advanced on Salaries of Employees.

052.212—Special Fees.

052.213—Time Slips—Time Tickets.

052.2131—Time Checks.

052.2131.1—Errors in Payment.

052.2131.2—Letters of Transmittal.

052.214—Pay Rolls—Checks.

052.2141—Errors in Payment.

052.2142—Deductions from Payroll.

052.2143—Claims for Wages Due.

052.2144—Unclaimed Wages.

052.215—Garnishments.

052.22—Material Accounts—Invoices for Material.

(Note:—File under Specific Equipment of thing involved, if possible.)

052.23—Consumers' Deposits.

052.24—Personal Expense Accounts and Reliefs—Accounts Covering Board and Lodging.

052.241—Cash Advanced on Expense Accounts.

052.25—Transportation Accounts (Freight, Express, Teaming—Livery.)

052.251—Freight and Express.

052.252—Teaming and Livery.

052.26—Rentals.

052.27—Taxes and Assessments.

052.29—Other Accounts Payable.

052.293—Hood River Gas & Electric Co.

052.294—Hanford Irrigation & Power Co.

052.295—Portland Gas & Coke Company.

052.296—Washington Irrigation & Development Co.

052.297—Columbia Valley Reclamation Co.

052.3—Earnings and Expenses.

052.31—Estimates and Statements of Earnings and Expenses.

052.311—Summary of Consumers' Ledger—Rebates and Allowances to Consumers.

052.313—Electric Properties.

052.314—Gas Properties.

052.315—Water Properties.

052.316—Railway Properties.

052.33—Increases and Reductions in Earnings and Expenses.

052.34—Departmental Expenses.

052.341—Executive and Legal.

052.342—Property and Right-of-Way.

052.343—Engineering and Construction.

052.345—Operating.

052.346—Financial and Accounting.

052.347—Merchandise Sales.

052.348—New Business.

052.4—Reports.

(Note:—All reports covering troubles or characteristics of operation should be filed under the specific equipment or thing involved if possible; otherwise under 359-459-559 or 659.)

052.41—Annual.

052.42—Monthly.

052.421—Monthly Bulletin.

052.43—Weekly.

052.44—Daily.

052.45—Construction Reports.

(All progress and other reports relating to construction work shall be filed here. All reports on any job shall be filed together, a separate folder being used for each job. The job number of "IR" shall appear on each report in addition to the file number, thus: E—052.45, I. R. 486.)

052.49—Other Reports.

052.5—Inventories and Stores.

052.6—Tank Account.

052.7—Accounting Methods.

052.71—Classification of Accounts and Matters Relating to Distribution of Charges.

(Note:—File under the specific document if possible, such as pay rolls, time slips, reliefs, invoices, requisitions, purchase orders, credit, memorandums, memorandums of transfer, etc.)

(All construction Foremen are considered as representing Construction Offices.)

061—Offices (Operating and Construction.)

061.01—Assignment of Space—Additional Space—New Quarters.

061.3—Office Methods.

061.31—Correspondence (Handling, Mailing and Other Matters Regarding Same)

061.311—Addresses and Mailing Lists.

061.312—Requests for Replies.

061.313—Filing of Correspondence.

061.314—Misdirected and Forwarded or Lost Correspondence.

061.34—Public Policies—Treatment of Customers.

061.35—Instructions to Managers and Other Representatives.

061.36—Instructions to Employees—Their Ability and Work.

061.4—Complaints.

061.43—Complaints of Electric.

061.431—Service.

061.432—Equipment.

061.433—Rates.

061.434—Appliances.

061.44—Complaints Gas

061.441—Service.

061.442—Equipment.

061.443—Rates.

061.444—Appliances.

061.45—Complaints Water.

061.451—Service.

061.452—Rates.

061.46—Complaints Railway.

(Where possible, file under specific subject.)

061.47—Complaints Material and Merchandise.

061.471—Prices.

061.472—Quality and Quantity.

(Where possible, file under specific item.)

061.6—Automobiles—Motorcycles—Bicycles.

061.8—Customers' Services.

061.81—Electric Services.

061.811—Connections.

061.812—Disconnections.

061.813—Methods or Manner of Handling.

061.814—Reports of Work Done.

(For local office only.)

061.82—Gas Services.

061.821—Connections.

061.822—Disconnections.

061.823—Methods or Manner of Handling.

061.824—Reports of Work Done.

(For local office only.)

061.83—Water Services.

061.831—Connections.

061.832—Disconnections.

061.833—Methods or Manner of Handling.

061.834—Reports of Work Done.

[To be continued.]

COST OF ELECTRIC COOKING.

In the course of a paper regarding the value of electric heating devices to the central station recently presented before the Canadian Electrical Association, H. S. Brown gave some figures on the cost of cooking for an average family of five persons with current at 3 cents per kw.-hr. His tests were as follows:

	Break-fast. Kw.-h.	Food.	Dinner. Kw.-h.	Food.	Supper. Kw.-h.	Food.
Mon.....	.657	Oatmeal, Dropped Eggs on Toast, Toast, Coffee.	1.219	Pork Chops, Fried Apples, Boiled Potatoes, French Toast, Sauce for French Toast, Coffee.	1.338	Omelet, Fried Potatoes, Muffins, Tea, Preserves.
Tues....	.366	Corn Flakes, Fried Eggs, Toast, Coffee.	3.085	Roast Beef, Mashed Potatoes, Baked Macaroni, Caramel Pudding.	1.030	Creamed Codfish, Popovers, Preserves, Tea.
Wed.....	.581	Oatmeal, Meat on Toast, Toast, Coffee.	1.348	Soup, Steak Broiled, Steamed Potatoes, Vegetable Salad, Suet Pudding, Coffee.	.934	Beef Warmed Up, Boiled Potatoes, Bread, Tea, Cake.
Thurs...	.948	Corn Flakes, Fried Bacon, Fried Eggs, Muffins, Coffee.	1.424	Lamb Chops, Creamed Potatoes, Green Peas, Apple Pie, Coffee.	.460	Baked Beans, Toast, Sauce, Tea, Cake.
Friday..	.713	Oatmeal, Hash, Toast Coffee.	1.071	Tomato Soup, Fried Ham and Eggs, Mashed Potatoes, Turnips, Coffee Jelly, Coffee.	1.302	Creamed Beef, Fried Potatoes, Toast, Tea, Layer Cake.
Sat.....	.618	Cornflakes, Fried Smelts, Toast, Coffee.	1.393	Boiled Halibut, Egg Sauce, Steamed Potatoes, Stewed Tomatoes, Pie, Coffee.	1.192	Scrambled Ham and Eggs, Cranberry Sauce, Biscuits, Tea, Layer Cake.
Sun.....	.610	Pork Chops, French Toast, Coffee.	4.019	Roast Turkey, Cranberry Sauce, Potatoes, Onions, Suet Pudding.	.741	Cold Roast Turkey, Biscuits, Tea, Cranberry Sauce, Pork Cake.
	4.493		13.559		6.997	
Total kw.-h. for seven days.....25.049						

Electrical standardization in China is being sought by the Engineering Society of China. A committee appointed to consider the subject has arrived at the following recommendations and decisions, which have been circulated as widely as possible in Europe and America in order to obtain free and valuable discussions and suggestions:

1. That generation and distribution generally shall be on 3-phase system at 50 or 60 cycles per second.
2. That distribution shall be carried out generally on the 4-wire 3-phase system with grounded neutral at a pressure of 250 volts between 1-phase and neutral, i. e., 440 volts (approximately) between phases.
3. That the standard pressure for domestic lighting and similar supply shall be 250 volts.
4. That when it is not desirable or economical to use a 4-wire 3-phase supply, then a 3-wire system with neutral grounded or a 2-wire system with one side grounded shall be adopted; in all cases the pressure to ground shall be 250 volts.
5. That the use of direct-current systems shall be discouraged and they shall not be allowed for systems involving either over 50 kilowatts in capacity or having feeder of over one-half mile in length.
6. That no fuses or switches shall be allowed in the neutral wire.
7. That where direct-current systems are essential the generation and distribution shall be on the 3-wire system at 500 volts between outers, the neutral being grounded.
8. That the following pressures shall be considered as standards for high-tension transmission: 2200 volts, 3300 volts, 6600 volts. Pressures above 6600 volts to be required by local and other conditions.

A Canadian water-power exhibit is planned for the Panama-Pacific International Exposition. Models of typical installations representing the low-head plants of Eastern Canada and the high-pressure plants in British Columbia are to be arranged in a semi-circle, behind which will be a representative landscape painting. The painting, which is to be 9 ft. high and 75 ft. long, will be executed by a noted landscape artist of Toronto.

The Adamson bill regarding the construction of dams across navigable streams was passed by the House of Representatives on August 4th. It provides that plans and specifications for such dams must be approved by the Secretary of War and the Chief of Engineers before work of construction is commenced. Approval may include the condition that water-power

to operate locks, etc., be supplied without cost, or a reasonable annual charge may be made for the benefits that accrue to the grantee by the authority given under the act. The dam shall be so located as to be best adapted to a comprehensive plan for the improvement of the waterway for the use of navigation and for the full development of the water-power.

The rights granted under the act extend over a period of fifty years beginning on the date of the original approval. Upon two years' notice prior to the expiration of the grant the United States has the right to take over the property of the grantee necessary and useful for the generation, transmission and distribution of energy, the payment therefor being based on the actual cost of the lands purchased and used by the grantee and the fair value of the other properties taken over. Allowance will be made for deterioration but not for good will or profit in pending contracts.

The Secretary of War is empowered to prescribe reasonable rates of charges for energy transmitted in "interstate or foreign commerce." When the energy is used within a state having adequate regulation for rates and service to the consumer the Secretary of War will not interfere with the established rules for rates and service.

The elimination of metallic resistance has been practically accomplished by Prof. Omnes of Leyden by reducing the temperature of the conductor to within a few degrees of absolute zero by placing it in liquid helium.

Electrical stimulation of plant growth is being extensively tried by W. J. Anson on a small tract of land near Wilmar Station on the Covina line of the Pacific Electric Railway of Los Angeles. Tile conduits have been laid in the soil to a depth of from 14 to 16 in. and carry iron wires tapped from a feed line across the end of the plot. According to the inventor, the treatment not only aerates and retains moisture in the soil, but also removes danger of frost damage, as a resistance coil may be placed at each tree.

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NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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The ideal advertisement is said to have never been written. In the sense that a specification is an advertisement of the thing required, many are still very far from a "realizable ideal"—something inconceivable to the average mind. It is important in engineering works that the materials supplied be "up to specification." This involves that the specifications be possible of fulfillment and that the purchaser satisfy himself that the materials supplied are in accordance with the specifications.

Honesty is the prime essential in each instance. But, like man who evolves it, a specification is usually fearfully and wonderfully made.

The art of writing specifications seems always to be somewhat in advance of practicability. Consequently fewer bids are submitted, as many fear that they cannot conscientiously live up to the specifications. They therefore, eliminate themselves as competitors, because they have no means of determining that no one could actually live up to the specifications as written. They think that their facilities have not enabled them to keep up with the rapid advance of their craft, and so they leave it to those better informed as to this situation to secure the business, though with no better product or possibilities than their own, and only too often at an unnecessarily high price.

Advantage is also taken of the fact that but few purchasers have the facilities for so testing the materials supplied that they can be certain that their purchases are up to the mark set, even when that mark comes within the bounds of the practical. This fact also is not known to the fearsome bidder and would probably not be taken advantage of, even if it were.

To the extent that a specification is outside practical bounds it destroys its own purpose, especially in destroying the widest competition. Herein lies the injury of a false ideal.

An overdrawn specification may also defeat its purpose through too strongly tempting the honesty of bidders, some of whom may succumb to the temptation in these strenuous days of co-operative competition, especially when it is known that the purchasing corporation with its ideal specification, has no means of determining whether it is lived up to.

It is time that the various bodies interested—research societies, engineering associations, manufacturers, agents, contractors and purchasers, get together in the writing of specifications worthy the service for which they are required. We live in a practical age. Because this is so, the specification should consist of a definite, particularized and complete statement of the thing actually required and possible of delivery. There is a gaping gulf between the ideal and the real which may never be spanned. The next requirement is the establishment by all large corporations of adequately equipped testing laboratories which will enable them to determine whether their practical specifications are lived up to, and which will serve as a silent monitor to those bidders who are inclined to be not quite as honest as might be desired.

So, may yet another hole be unplugged in the hull of the pirate craft of unfair competition.

Governmental activity in the extension of markets has created keen interest among manufacturers. Commerce of today abhors national conflict, though innumerable wars of the past had their origin in the need for the extension of markets on the part of the nations involved.

Promoting Our Peaceful War

Actual warfare is now recognized to be confusion worse confounded; loss, uneconomical even where the territory or concession desired is ultimately obtained. The devastating influence of war is world-wide and its avoidance in any quarter a matter of interest to all. The interdependence of the trade of nations offers a further argument against the precipitation of international quarrels.

Being in the quarrel, none would, however, wish to limit, through lack of finances, the operations of army or navy. Under these circumstances, the enormous, eagerly voted appropriations made by the great powers of Europe, are commendable, though the possible gain is insignificant compared with what might have been expected from a direct use of the money for manufacturing purposes, or by the various nations in the extension of markets for the overproduction of the factories within their borders.

Governments are generally penurious in voting appropriations for the purpose of making possible the commercial victories of peace. Thousands are then expected to do the work of the millions voted for warfare.

Our own government is no exception to this rule, and in the light of recent developments the hundred thousand dollars lately voted for the extension of markets certainly appears small. What might not be accomplished by the willing expenditure for peace purposes of the enforced amounts spent in times of war? And to do this would be to make war economically impossible.

The United States is often referred to as making a gradual though peaceful conquest of the world by successfully selling its manufactures in the markets of all nations, but the complete realization of this plan will be indefinitely postponed unless a commensurate governmental monetary backing is assured. Otherwise the necessary men of wide outlook, of business acuity and imagination wide as genius can devise, cannot be secured to occupy the important proposed positions as commercial attaches of the government.

The plan is perfect, for the scientific management of a business consists in action based upon definite knowledge, and that of a nation is predicated upon the same principle.

The amount available for the remuneration and expenses of these commercial attaches, and for the allied plans having for their common object the extension of markets is undoubtedly much smaller than the annual expenditures of many private corporations for the same purpose.

The United States would not be behind European countries in the magnificence of her monetary backing of her arms in time of actual warfare and this precludes any possible excuse for such niggardliness in promoting her peaceful war with its ultimate object of the commercial conquest of the world.

In these latter days of conversation about conservation some attention is being given to the conservation of that most precious of energies, the human workman. Managers are studying the best way to develop human forces, the most efficient methods in applying them, and the wisest means to conserve them. Business, as a complicated action and reaction of forces, is largely a matter of human engineering. Even cold business is being warmed into thoughts of kindness by the stern knowledge that whatever dissipates the energy of the worker is a handicap to effective production.

Welfare Work

Much of this conservation of human energy is being accomplished by welfare work, a direct interest of the employer in the comfort and well-being of his employees. While this interest was originally inspired from a sentimental standpoint, the results have shown that, like honesty, it is also the best business policy. Today it may be truly termed the capitalization of philanthropy.

Man-power costs more than any other form of energy in commercial use. All the boasted increased efficiency and conservation of water, steam, gas and electric power is of little avail without a corresponding increase in man-power. This is now being done by welfare work, whose prime purpose is to conserve human forces and to promote industrial progress.

A tired man cannot do efficient work.

The three physical fatigue factors which can be most easily remedied are light, air and temperature. Good light, properly distributed, enables man to do good work for long periods; what is needed to conserve vision and prevent eye fatigue is not more light, but better light, light with less glare. Good ventilation and a proper working temperature also prevent needless exhaustion. These factors, together with sanitation, however, are getting beyond the experimental stage of philanthropy and are now being required by law.

Much is also being done to improve the psychological environment of workers by providing for their comfort, instruction and recreation. Medical service, reading rooms, gymnasiums, pension systems, life insurance, lectures, and the like represent an effort to increase the physical, mental and moral welfare of the employees in the knowledge that contented men do more and better work.

The increased efficiency of the individual is the goal of all such welfare work. Any means which a company can adopt to emphasize the individual element adds to the co-operative spirit which binds the organization together. The Southern California Edison Company of Los Angeles, for example, has adopted an insignia, known as "the Edison emblem," as a reward for long, honest and honorable service. Many other methods are being tried to cultivate a sense of individual responsibility and individual pride in performance. More intimate contact or at least more direct contact, between employer and employee, creates a sympathetic understanding and is the means of establishing harmony between capital and labor.

PERSONALS

M. L. Scobey, salesman with the San Francisco office of the Pacific States Electric Company, is at Portland.

B. Cooper, purchasing agent of the Southern Sierras Power Company, spent the past week in San Francisco.

H. B. Squires, electrical manufacturers' representative, has returned to San Francisco from an extensive Eastern trip.

W. Baird of the Baird Electric Company, Modesto, California, spent several days during the week in San Francisco.

J. G. McDonald, president of the West Side Gas Company, Taft, California, was a visitor to San Francisco during the week.

C. S. MacCalla, general manager of the Washington Water Power Company, has returned to Spokane from Gearhart, Ore.

R. F. Hayward, general manager Western Canada Power Company, has returned to Vancouver, B. C., from an extended trip through eastern cities.

W. P. Todd, salesman for the Western Electric Company, San Francisco, is making a business trip through the Coast country region of California.

Harry Bayford, of Vancouver, B. C., has joined H. M. C. S. Rainbow, as electrician. The Rainbow is aiding in the protection of the Pacific Coast.

H. W. Cope, director of exhibits, Westinghouse Electric and Manufacturing Company, San Francisco, returned during the week after a trip to Pittsburgh.

E. F. Suys, president of the Northern Electric Company, Ltd., and **M. B. Pike**, manager of branches, were at Vancouver and Victoria, B. C., during the past week.

E. H. Verner, engineer of Port Coquitlam, B. C., has been appointed by the Maillardville council to make an estimate of the cost of installing a water system.

W. L'Homedieu, manager of the railway and lighting department, Westinghouse Electric and Manufacturing Company, San Francisco, left for a trip through Southern California.

W. R. Jones, inspector of Canadian Pacific Railways Telegraphs, has been appointed inspector of telegraphs, with headquarters at Lethbridge, Alta., on a newly created division there.

C. W. Van Dyke, president and general manager of the Miami Light and Power Company and Miami Telephone Company, Miami, Arizona, spent the week in San Francisco on a business trip.

R. L. Phelps of Pierson, Roeding & Co.'s San Francisco organization took one of the principal parts in the annual jinks of the Bohemian Club at Bohemian Grove, which were attended by many electrical men.

Francis E. Wilkinson has returned to San Francisco from a two months trip to Europe, where he was reporting to financial interests regarding California developments. He is making local headquarters in the Mills Building.

T. S. Dick, traveling auditor of the Westinghouse Lamp Company, with headquarters in New York City, is in Salt Lake City checking up the Inter-mountain district of this company with headquarters there. His work will require from one month to six weeks.

Hal Lauritzen, Pacific Coast manager of Holophane Works of the General Electric Company, San Francisco, and **J. T. Stewart** of the same company, have returned from an extended trip through the East, during which they visited the home office and works of their concern.

Robert L. Eltringham, safety engineer with the Industrial Accident Commission of California, located at San Francisco, is on an investigating trip through Los Angeles and

Southern California, during which he expects visiting all the power, central station and electric railway plants.

James Fell, officer commanding the Sixth Field Company of Canadian Engineers, is advertising in Western Canadian papers for recruits. This company is located at North Vancouver, B. C., and in his advertisement Major Fell mentions electrical engineers and telegraphists as particularly desired.

J. E. Boesch, distribution engineer B. C. Electric Company, Vancouver, B. C., who holds a commission in the Engineering Corps of the Swiss army, has been recalled to his native country on account of the unrest in Europe. Switzerland is mobilizing an army of 175,000 in order to ensure the maintenance of her independence. Mr. Boesch is a member of the A. I. E. E.

A. L. Woodhouse, general manager of the Beaver River Power Company, with headquarters at Richfield, Utah, is in Salt Lake City to attend a meeting of the board of directors of the Capital Electric Company and to confer with L. L. Nunn, president of the Beaver River Power Company. Mr. Nunn is also in Salt Lake City in connection with the suit now pending against the Beaver River Company, alleging trespass on federal lands. The grounds of the suit are similar to those heretofore filed against the Utah Power & Light Company and the Utah Light & Railway Company.

C. A. Hansen, specialist for the General Electric Company on the electric furnace and the electrical separation of zinc and copper, is in Salt Lake City for the purpose of going over the works of the Utah Copper Company at Bingham for the purpose of determining the feasibility of applying electrical ore separation to their work. Managing Director **D. C. Jackling** of the Utah Copper Company, who is also president of the Utah Power & Light Company, which has a contract with the copper company for supplying the electrical requirements of all of their smelting and mining work, is very much interested in the problem and is lending every assistance toward its solution.

O. L. Waller, of the state college at Pullman, Wash., is conferring with the farmers in regard to preventing separator fires and explosions, the growing number of which is causing considerable alarm in this part of the state. One farmer has advanced the theory that the explosions are due to the electricity generated in the separator. He has connected copper wires to the journals of his machine and has attached these to bolts driven into the ground which he waters thoroughly. His machine has been operated without trouble under this precaution. Professor Waller recommends running exhaust steam into the separator near the cylinder in order to slightly dampen the atmosphere. It is feared that this last method may damage the grain.

R. H. Sperling, retiring general manager of the British Columbia Electric Railway Company, Vancouver, B. C., was recently given a farewell social and presentation. Dancing and a musical program provided the entertainment for those present. The presentation was made during the evening and consisted of a solid gold cigar box suitably engraved and bearing the Sperling family coat-of-arms. Mrs. Sperling was the recipient of a magnificent diamond ring. The presentation was made by **F. S. Barnard**, a resident director of the company, who referred to Mr. Sperling's success in the position which he was relinquishing in order to take up more important work on the board in London. Mr. Sperling in reply thanked the staff for their loyal co-operation which had made possible his measure of success and hoped that the social evenings started under his administration would be continued. He asked for a continued support for the new general manager. **A. G. Perry**, local manager at North Vancouver, presented a framed picture of the members of the North shore staff. On Monday evening a farewell banquet was given Mr. Sperling at the Hotel Vancouver by the officials of the company, which was presided over by **George Kidd**, now general manager of the company. Representa-

tive officials from all over the company's extensive system were present. The toasts of the evening were to The King; Our Province, proposed by W. G. Murrin, mechanical superintendent, and replied to by A. T. Goward, manager of the Victoria branch; Our Company, proposed by C. Rummel, manager light and power department, and responded to by C. R. G. Conway, chief engineer; Our Guest, proposed by General Manager George Kidd, and seconded by F. R. Glover, general executive assistant. Musical and other entertainment was provided. The table was arranged in the form of a horseshoe, about 75 ft. long, one of the features of the decorations being a miniature third rail system which operated continuously though not quite as smoothly as the company's system. The ends of the horseshoe were spanned by a suspension bridge.

MEETING NOTICES.

Safety First at Salt Lake City.

On August 12th the Utah Light & Railway Company called a special meeting of all of their employees at which Mr. E. M. Bagley, the company's claims attorney, and Mr. L. E. Abbott, commissioner of safety for the Oregon Short Line R. R. Company and members of the Utah Light & Railway Company's Safety Committee gave illustrated talks and demonstrations on the "Safety First" movement. Two sessions were necessary in order to accommodate all of the company's employees. The meetings partook somewhat of the nature of a smoker, cigars and light refreshments being served.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL INSPECTORS—SECTION N. A. E. I.

A meeting of the above section was held in the city hall, Vancouver B. C., on July 31st., the following being present: C. H. Fletcher, city electrician, Vancouver, and J. W. Cook, W. C. Jenkinson and T. F. Walker, of his department. R. J. Roache, electrical inspector, Point Grey; C. Stearn, city electrician S. Vancouver; and O. Mansfield, Light & Power department, B. C. Electric Railway Company.

After routine business and other matters had been transacted the following questions submitted by the parent association were discussed, the answers as given being unanimously agreed upon:

Ques.—Would you consider that Rule 30 (a) had been complied with if the insulating joint is omitted where a chain fixture 6 ft. long is suspended from the conduit outlet, and the outlet is controlled by a switch (the fixture being too high to be reached from the floor) cord being used No. 16 with 3/64 insulation and common brass shell socket?

Ans.—No. It would require an approved socket as provided for in 30 (a).

Ques.—Does "in which the insulation of conductors is the equivalent of insulation in other parts of the system," allow the use of wire as No. 10 or No. 16 provided the insulation is the same as for conduit work, namely, 3/64 in.

Ans.—Yes. Provided it is used for the wiring of fixtures only.

Ques.—Are common brass shell sockets considered the "equivalent insulation" of porcelain as applied to this rule?

Ans.—No.

Ques.—Regarding Rule 32 (e). Is the prohibition against flexible cord in show windows intended to apply to the permanent lighting only or also to temporary displays of portable lamps, flat irons, and other electrical devices? If one carries in mind the distinction between pendant cord and portable cord, will the answer be different?

Ans.—The ruling on both questions is, that Rule 32 (e) prohibits the use of portable cords.

Ques.—Is it permissible to run a ground wire in the same conduit with other wires of the same system?

Ans.—Yes.

Ques.—In a steam bakery oven it is desired to run a conduit about 6 ft. long inside the brickwork where the temperature will reach 400 deg. F. What kind of insulation should be used in this case?

Ans.—Slow-burning wire should be used.

Ques.—What is considered proper ventilation under Rule 33-a-7? If a flue is required should it not be installed in a manner similar to smoke flues of furnaces; that is to say, with air spaces or other heat insulation between the flue and the near woodwork?

Ans.—An air space would be required.

Ques.—Rule 86 (a) requires aerials grounded on street side of water service cock. In case of very high buildings this imposes considerable hardship which might perhaps be removed in the case of steel skeleton buildings by grounding on this itself, of course being careful that all pipes are bonded on steelwork on floor where ground wire is attached and also in basement. Would such an arrangement be considered proper?

Ans.—Would consider that the steel frame of the building would be equal to the water pipe.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Lindsay Home Telephone & Telegraph Company, operating in the City of Lindsay, Tulare County, has filed an application with the commission asking authority to borrow \$2000 and to issue its notes therefor. The company expects to use the larger portion of this sum in connecting new subscribers and making additions to its plant.

The commission has rendered a decision authorizing the Modesto Interurban Railway, operating between Modesto and Empire, to issue 144 shares of its capital stock at the par value of \$100 per share. This stock is to be issued to various persons in return for property, cash advanced and other obligations.

The Hanford Gas & Power Company of Hanford, Kings county, has filed an application with the commission asking authority to issue its note for \$6000 for 90 days at 6 per cent interest, to be used in renewing a loan with the Wells, Fargo, Nevada National Bank.

The San Joaquin Light & Power Corporation has filed a complaint with the commission against the Tulare County Power Company. The complaint alleges that the Tulare County Power Company is indebted to the San Joaquin Light & Power Corporation in the sum of \$15,619 for electric energy furnished under contract. The commission is asked to order the payment of this sum, or in lieu thereof, to order the Tulare Company to discontinue further extensions to its system and apply its earnings to the liquidation of its indebtedness, or to allow the San Joaquin Company to discontinue service until the sums owing it are paid in full.

The commission has rendered a decision authorizing the San Joaquin Light & Power Corporation to issue a promissory note in the sum of \$10,000 for the purpose of refunding a note in like amount.

The commission has made a supplemental order authorizing the San Diego Consolidated Gas & Electric Company to apply the proceeds from the sale of \$23,000 bonds against construction expenditures incurred between May 31 and November 1, 1914.

The commission has made a supplemental order authorizing the Southern California Gas Company to use the sum of \$165,033.19 derived from the sale of certain preferred stock for the purpose of reimbursing its treasury for capital expenditures made in connection with improvements to its plant and system.

The commission has rendered a decision authorizing the Montecito Railroad Company to issue 50,000 shares of capital stock of the par value of \$1.00 each. The proceeds from the sale of this stock are to be used by the company to build a street railroad 2.4 miles in length in the city of Los Angeles.

ELECTRICAL CONTRACTORS' DEPARTMENT

CONTRACTORS' CONVENTION AT SACRAMENTO.

The fifth annual convention of the California Association of Electrical Contractors and Dealers held at Sacramento from August 4-8, inclusive, was the most successful in the history of the organization. This success was not only in point of attendance, 193 registered, but also with regard to results accomplished.

The first three days of the convention were devoted to consideration of matters of interest primarily to the contractors, while the balance of the time was occupied with subjects of public concern. The new constitution and by-laws was the subject of much interesting discussion, as was also the matter of standard specifications to be supplied to architects.

Standard specifications for wiring of buildings for telephone service were adopted in co-operation with the Pacific Telephone & Telegraph Company. It includes all details for wiring telephones in buildings except the main terminal cab-

tion and dance on Wednesday evening, during the course of which Mr. Geo. C. Holberton gave an illustrated lecture on the system of the Pacific Gas & Electric Company. On Thursday afternoon a long automobile ride was taken through Sacramento valley and in the evening a moonlight boat ride and dance was held.

The annual dinner on Friday evening was a gastronomic and musical feast. Among the guests Mrs. Fannie Forrester Wellman and Miss Elliott favored those present with several musical selections by special request. Mr. Tom Scott acted as toastmaster, calling in turn on A. H. Elliott, C. V. Schneider, Claude Loveday, who presented a handsome cut glass bowl to Mrs. Schneider as an expression of appreciation from the ladies, Mrs. Schneider gracefully responded, W. H. P. Hill, F. J. Symmes, J. C. Renler, W. L. Goodwin, W. S. Berry, C. J. Mitchell and W. S. Hanbridge.

On Saturday an outing and picnic was enjoyed at Smith's Mound on the Sacramento River nearly two hundred con-



Group of Electrical Contractors at Sacramento.

inet. The telephone company's inspection department will approve all plans before and after construction work is started.

In the closing session of the members C. V. Schneider of Sacramento was re-elected president and the association affairs placed in the hands of a board of management, whose members are C. V. Schneider, president; W. S. Hanbridge, San Francisco, secretary; F. J. Somers, San Jose; J. Boynton, San Francisco; Geo. Gilpen, Oakland; and Claude Loveday, Santa Barbara. San Francisco was selected as the 1915 meeting place, the meeting to be distinct from that of the national association.

The papers presented at the public meeting on Friday were all concerned with methods by which the contractors could co-operate with each of the other branches of the electrical industry. W. W. Briggs spoke as the representative of the central stations; C. E. Heise from the standpoint of the manufacturer; T. R. Hunter showed the relation with the engineer; H. V. Carter represented the jobbers' viewpoint; C. F. Butte dwelt on the contractors' side and A. E. Elliott summed up the entire situation in an address on co-operation. The several papers will be published in this and succeeding issues.

Entertainment.

The entertainment of the members and guests was most lavish and too much credit cannot be given to those having the various features in charge. It started with a recep-

tion and dance on Wednesday evening, during the course of which those who so desired could enter the fishing contest, while the others danced or competed in the long list of sports. Prizes were awarded to the winners of the various contests. Dancing was also indulged in during the return trip, the crowd reaching Sacramento tired but happy, in time for dinner. An automobile trip was arranged for the ladies while the rejuvenation was in progress on Saturday night. A hearty vote of thanks was extended to the electrical people of Sacramento for their hospitality.

The following list shows who registered at the convention:

Alexander, Earl G., Alexander & Lavenson, San Francisco.
 Alvord, R. M., General Electric Co., San Francisco.
 Ames, Chick, National Electric Co., San Francisco.
 Baker, Sylvester A., Macbeth, Evans Glass Co., S. F.
 Baruch, S. N., Boruch Elec. Con. Corp., Oakland.
 Battee, Geo. H., Elec. Agencies Co., San Francisco.
 Berry, W. S., Western Electric Company, San Francisco.
 Boynton, Mr. and Mrs. J. R., Central Electric Co., S. F.
 Briggs, W. W., Great Western Power Co., San Francisco.
 Britling, Ed., Scott, Lyman & Stack, Sacramento.
 Brockway, Mr. and Mrs., Latourette-Fical Co., Sacramento.
 Burkhart, E. F., Palo Alto.
 Butler, Miss, Pacific States Elect. Co., San Francisco.
 Butte, Mr. and Mrs. C. F., Butte Elect & Mfg Co, S. F.
 Camp, W. E., General Electric Co., Sacramento.
 Carlson, Jos. M., Central Electric Co., San Francisco.
 Carter, H. V., Pacific States Electric Co., San Francisco.
 Commerford, A. E., J. C. Hobrecht Co., Sacramento.
 Conrad, Mr. and Mrs. R. H., Conrad Elec. Co., Oakland.
 Crombach, Mr. and Mrs. John A., Sacramento.

Daley, H. H., Westinghouse Lamp Co., San Francisco.
 Douglas, Mr. and Mrs. R. L., Great Western Pr. Co., Sac.
 Dieferbroch, M. H. and family, Sacramento.
 Dillon, Mr. and Mrs. Thos. J., Great Western Pr. Co., Sac.
 Dolan, Mr. and Mrs. W. C., Electrical Supply Co., Sacramento.
 Drew, Mr. and Mrs. Geo. H., Pacific States Elec. Co., Oakland.
 Dunbar, W. R., Westinghouse Elect. & Mfg. Co., S. F.

Eckland, Mr. and Mrs. H. R., San Rafael.
 Ellison, Mr. and Mrs. Frank, City of Oakland, Oakland.
 Elliott, Mr. and Mrs. Albert H. and daughter, Attorney, S. F.

Fagan, F. D., General Electric Co., San Francisco.
 Fagg, J. H., Pacific Gas & Elect. Co., Sacramento.
 Flanagan, A. F., Elec. Eng. & Supply Co., Stockton.
 Fulton, A., General Electric Co., San Francisco.

Gensler, Mr. and Mrs. J., Oakland.
 Gibson, B. Y., Elect. Ry. & Mfg. Co., San Francisco.
 Gill, C. R., P. G. & E. Co., San Francisco.
 Gilpen, Mr. and Mrs. S. B., Piedmont Elec. Co., Oakland.
 Goodwin, W. L., Pacific States Elec. Co., San Francisco.
 Graham, Chas., Graham & Lamus Co., Sacramento.
 Gregory, Mr. and Mrs. S. B., Arrow Elec. Co., San Francisco.
 Gribble, Wm. H., Kimball Elec. Co., Oakland.
 Griswold, A. E., A. G. Electric Co., Seattle.

Halloran, A. H., Journal of Electricity, San Francisco.
 Hanbridge, Mr. and Mrs. W. S. and daughter, S. F.
 Hansen, B. A., A. G. Electric Co., San Francisco.
 Harris, D. E., Pacific States Electric Co., San Francisco.
 Hartzell, H. C., Maydwell Co., San Francisco.
 Heise, C. E., Westinghouse Elec. & Mfg. Co., San Francisco.
 Herbert, C. H., Westinghouse Elec. & Mfg. Co., S. F.
 Hill, B. C., City of Oakland, Oakland.
 Hill, Mr. and Mrs. W. N. P., Great Western Power Co., Sac.
 Hillis, C. C., Electric Appliance Co., San Francisco.
 Hobrecht, Mr. and Mrs. J. C., Sacramento.
 Holberton, Geo. C., P. G. & E. Co., San Francisco.
 Hooker, J. W., Thomas Day Co., San Francisco.
 Hope, Mr. and Mrs. N. M., The Turner Co., San Francisco.
 Hyde, P. B., Thos. A. Edison, Inc., San Francisco.

Jacobs, J. C., Jacobs Electric Co., So. Pasadena.
 Jarvis, Mr. and Mrs. T. P., San Francisco.
 Johnson, C. E., Am. Ever Ready Co., San Francisco.
 Johnson, C. M., San Francisco.

Keyes, H. C., Dunham, Carrigan & Hayden Co., Sacramento.

Lamus, Mr. and Mrs. C. A., Graham & Lamus Co., Sac.
 Lewis, W. B., Western Electric Co., San Francisco.
 Levy, Mr. and Mrs. Louis, Levy Elec. Co., San Francisco.
 Libby, Mr. and Mrs. F. C., Scott, Lyman & Stack, Sacramento.
 Loveday, Mr. and Mrs. C., Santa Barbara.

McDonnell, Wm., Electrical Supply Co., Sacramento.
 McNally, Mr. and Mrs. W. A., Pasadena.
 Mitchell, C. W., Board of Fire Underwriters, San Francisco.
 Murray, E. K., Western Elec. Co., San Francisco.
 Musladin, Chas. R., Alexander & Lavenson, San Francisco.
 Myers, Mr. and Mrs. Romaine W., Oakland, Cal.

Neelands, W. L., Western Elec. Co., San Francisco.

Pearce, Mr. and Mrs. G. Stanley, City of Sacramento.
 Peck, A. P., Electrical Supply Co., Sacramento.
 Pinger, Mr. and Mrs. F. C., Richmond, Cal.
 Poss, F. H., Benjamin Elec. Co., San Francisco.
 Potter, F. B., 424 E 16th street, Los Angeles.
 Powell, Mr. and Mrs. Noble, Stockton.

Rendler, Mr. and Mrs. J. C., So. California Elec. Co., L. A.
 Richmond, J., Decker Elec. Co., San Francisco.
 Robschelt, H. T., Westinghouse Lamp Co., San Francisco.
 Rowe, A. E., Tel. El. Equipment Co., San Francisco.

Sanderson, H. E., Bryant Elec. Co., San Francisco.
 Sayles, H. A., Holabird, Reynolds Co., San Francisco.
 Sawyer, C., 321 Mission street, San Francisco.
 Scott, Mr. and Mrs. Tom and daughter, Sacramento.
 Schloss, L. A., General Electric Co., Sacramento.
 Schultz, Mr. and Mrs. H. F., Electric Appliance Co., S. F.
 Schweiser, Misses, Sacramento.
 Scoville, W. D., Latourette-Fical Co., Sacramento.
 Scobey, M. L., Pacific States Electric Co., San Francisco.
 Shreve, E. O., General Electric Co., San Francisco.
 Sittman, Mr. and Mrs. Geo. A., Gen. Elec. Const. Co., S. F.
 Smith, Geo. D., Elec. M. & M. Co., San Francisco.
 Smith, Paul, Oakland.
 Smith, R. E., National X-Ray Reflector Co., San Francisco.
 Smith, Walter, J. C. Hobrecht Co., Sacramento.
 Somers, Frank J., Century Elect. Co., San Jose.
 Steel, Miles F., Benj. Elec. Mfg. Co., San Francisco.
 Strand Mr. and Mrs. W. A., Electric Stores Company, Sac.
 Stack, Mr. and Mrs., G. B., Sacramento.
 Symmes, F. J., Thomas Day Co., San Francisco.

Thieben, Jos., Panama Elec. Lamp Co., San Francisco.
 Thomas, W. D., Elec. Ry. & Mfg. Supply Co., San Francisco.
 Thompson, J. M., Johns-Manville Co., San Francisco.
 Tobey, J. O., P. G. & E. Co., Sacramento.

Valentine, Mr. and Mrs. Geo., Graham & Lamus Co., Sac.
 Vandegrift, J., National Lamp Works, Oakland.

Watts, Mr. and Mrs. Frank W., McFell Electric Co., S. F.
 Waxon, Peter, Waxon Bros., Sacramento.
 Waxon, Frank, Waxon Bros., Sacramento.
 Weber, E. C., Ickelheimer Bros. Co., San Francisco.
 Wellman, Mr. and Mrs. Geo. H., Electrical Review, Chicago.
 Welch, A. S., Electric Agencies Co., San Francisco.
 Werner, W. R., Pacific States Elec. Co., San Francisco.
 Wilkinson, Mrs. A., Association, San Francisco.
 Wilson, Fred W., Standard Underground Cable Co., S. F.
 Woods, J. A., California Mech. E. E. Co., Sacramento.
 White, H. J., Keeler, White & Co., San Francisco.
 Wylie, J. W., West Sacramento Electric Co., Sacramento.

Yost, H. F., Elec. Stoves Co., Sacramento.
 Youngbholm, A., Westinghouse Lamp Co., San Francisco.
 Youdell, L. F., E. & M. Equip. Co., Stockton.

Jovian Rejuvenation.

The convention was brought to a close by a rejuvenation of the Jovian Order on Saturday in the beautiful Elks hall, where was staged what is believed to be the most effective presentation of the ritual which has been exemplified in the West. Statesman C. S. Pearce and his co-workers deserve great credit for the manner in which the rejuvenation was conducted and the representative candidates initiated.

The degree team consisting of

Jupiter, R. L. Douglas
 Neptune, T. L. Nightingale
 Vulcan, C. A. Lamus
 Pluto, John H. Fagg
 Mercury, C. R. Gill

Hercules, J. O. Tobey
 Mars, L. A. Schloss
 Apollo, R. C. Eyerly
 Arcturus, J. C. Hobrecht

Imps: W. C. Dolan, H. F. Yost, H. A. Sayles, A. L. Comberford.

had memorized all their work and delivered it very effectively. Geo. H. Middlemiss contributed much harmony to the meeting by presiding at the piano.

The class of twenty included many of the most prominent electrical men of Sacramento who had not previously joined. They were as follows.

W. N. P. Hill, Manager Sacramento District, Great Western Power Company, Sacramento.

C. P. Taylor, Foreman, Substation Pacific Gas & Electric Company, Sixth and H streets, Sacramento.

C. W. Beaton, Chief Electrical Inspector, City Hall, Sacramento.

W. D. Thomas, Salesman, Electric Railway & Manufacturers' Supply Company, San Francisco.

H. T. Schultz, Salesman, Electric Appliance Company, San Francisco.

T. J. Dillon, District Superintendent, Great Western Power Company, 1024 K street, Sacramento.

J. W. Wylie, Manager West Sacramento Electric Company, Box 339, Broderick P. O.

S. W. Baruch, Vice-President, Electric Controller Corporation, 424 Thirteenth street, Oakland, Cal.

James W. Coons, Superintendent, Solano Power Division, Pacific Gas & Electric Company, Davis, Cal.

W. B. Smith, Salesman, J. C. Hobrecht Company, 1014 Sixth street, Sacramento.

R. H. Conrad, Manager, Conrad Electric Company, 564 Eighteenth street, Oakland.

C. H. Herbert, Salesman, Westinghouse Electric & Manufacturing Company, San Francisco.

Geo. B. Sanford, Manager, Rio Vista District, Great Western Power Company, Rio Vista, Cal.

W. D. Scovill, President Latourette-Fical Company, Thirty-fifth and Sacramento avenue, Sacramento.

Jas. A. Woods, President and Manager, California Mechanical & Electrical Engineering Company, 2906 R street, Sacramento.

T. P. Jarvis, Owner, Jarvis, Stearn & Electric Company, 275 Connecticut street, Sacramento.

Jos. W. Hooker, Salesman Thomas Day Company, 725 Mission street, San Francisco.

Jos. Thieben, President and Manager, Panama Electric Lamp Company, 595 Mission street, San Francisco.

E. A. Weymouth, Assistant Manager, Pacific Gas & Electric Company, Sacramento.

Sylvester A. Baker, Manager, Pacific Coast office Macbeth-Evans Glass Company, Rialto Building, San Francisco.

After the rejuvenation a Dutch lunch was served and several talks was given, Tom Scott acting as toastmaster. A. H. Halloran, National Vulcan, spoke of the purposes of the order, A. H. Elliott spoke on the benefits of co-operation, as did likewise A. E. Rowe, Statesman at San Francisco; C. S. Pearce, Statesman at Sacramento; R. M. Alvord and G. N. P. Hill.

HOW CAN THE CONTRACTOR AND DEALER CO-OPERATE WITH THE CENTRAL STATIONS.

BY W. W. BRIGGS.

The exponent of co-operation has been abroad in the land for some time and we have heard papers by the yard and speakers by the hundreds. Closely following are the exponents of scientific management and other uplifting projects. Without question this agitation must have accomplished some good—at least it has produced in our minds a desire to go further and look more closely for suggestions as to ways and means for the improvement of our condition and to seek for individual and practical applications of basic theory to our daily life.

I propose herein to give you a simple thought and theme to work on, and perhaps when this over with you will all wonder why so many words to convey such a simple idea. The only answer perhaps would be that we must make this kind of thing look difficult to accomplish and as representing deep study.

Without doubt the welfare of the central station, its development and sustained activity have much to do with the welfare of the contractor and dealer. Lack of progress and development and the shutting off of line extension due to lack of funds all tend to slow down the business of the contractor and dealer. Hence, they have a vital interest in the success and welfare of the central station.

Within the last year the public utilities have felt keenly the conditions of the world's money markets. Particularly have we in California been embarrassed, with large work on hand and the tremendous demands made by rapidly growing and widely scattered communities, making necessary the providing of vast sums for development purposes, which were indeed hard to get. Contributing to the general financial inactivity was the feeling of uncertainty as to the soundness of public utilities securities, owing to rapidly changing political conditions, the (to our people) somewhat untried question of regulation, etc.; but most of all, to my mind, the inactivity was occasioned by an almost universal feeling of unrest and dissatisfaction among the people as a whole. These conditions may be hard to explain. Certainly, I for one do not intend to indulge in obtuse theories on political economy, in the endeavor to do so, but will confine myself to the simple statement that, from personal observation, I believe that if the people as a whole have little faith in the management of the public utilities serving them it is because of lack of knowledge or study of the contributing conditions, and in consequence their minds are molded by irresponsible critics and editorial statements contained in the daily press, which in effect reflect the opinion of some who have not given the subject much thought.

We still hear reiterated the famous statement of what Commodore Vanderbilt said about the public, even though that gentleman has been dead at least 37 years, and his policies for about the same time. Just because we see in press daily reports of some man who has proven untrue to his trust or some scandal involving a woman's fair name, we are not convinced that there is no longer honor among men nor virtue in women, simply because we know that the honest man and woman rarely get their names in the paper except possibly in the society column—for some charity—or an auto accident. So I say to you, there are honest public utility companies—many of them, who are striving to give the public as well as their stock and bond holders a square deal.

I will grant without question that the subject of educating the public to some of the apparently insurmountable difficulties of utility management has been sadly neglected and that carping critics have been allowed to go unanswered, thereby creating the impression that there was no answer.

Personally, I am an advocate of the creation of a public utilities publicity bureau which, operating entirely in the open, would make it its duty to defend unjust charges against the different utilities. In my last eighteen months' experience as an official of a public utility I have been more impressed than ever before (although my entire commercial experience has been such as to bring me in close touch with the activities of electric power properties and their policies) with the fact that the utilities companies, almost without exception, have been endeavoring to do that which was right at all times.

However, to get down to brass tacks, so to speak, and say to you how you can co-operate and assist the central station industry now, thereby assisting to stimulate the electrical business.

The utilities companies seek the good will of those they

serve and the people at large. Their efforts to secure this result are continually combatted by ill-informed agitators and others who, for generally selfish reasons, continue to circulate statements misleading and unjust. You will meet this kind of person and those whose ideas have been molded by such general statements of condemnation as it seems usual for the demagogue to voice. My advice to you as one interested is "not to let them get away with it."

For example, if a casual acquaintance or customer should state as his belief that his electric, gas or water meter was running fast and that his serving company knew it, what would be your attitude? Would you ignore the remark and thus allow such an impression to continue in his mind, or would you, with the advantage of your technical knowledge, take the opportunity to explain the utter impossibility of this condition knowingly continuing, advising of the time, money and energy that the utilities put forth to be sure their measuring devices are correct, and the further simple fact that the manager of a utility company who would deliberately go about speeding up meters would have to have from 10 to 500 partners in crime, depending on the size of his plant. Even a crook would choke on such a condition.

In the event that a drastic underground ordinance was presented in a city council, by which a utilities company would be forced to expend large and unwarranted sums, not to increase its business or capacity to serve, and where the increased cost of service would inevitably go back to the ratepayer, would you be complacent and let the utility company carry the burden, or would you take advantage of your standing in the community and join with them in a proper presentation of the facts?

The incident of a city council endeavoring to pass such an ordinance is now before some of the central California companies, wherein the cost to do the work, without a chance of return (except by a radical increase of rate) would be sufficient to build distribution lines in one or two sparsely settled counties and afford electric power service where some good would result.

The central station manager must of necessity guard his expenditures in plant extension, putting most of them where a reasonable return may be expected, else he will have nothing for the lean spots.

If you will give some thought to these two points and a thousand others that might be mentioned except for lack of time, and then when opportunity arises never let a chance go by to state the facts, honestly, to your friends and neighbors, you will be doing the industry that provides you with a livelihood much good. It should be obvious that you yourselves must be convinced that the utilities companies are, so to speak, "on the square," and to that end I personally would be glad at any time to take up with you, singly or collectively, anything that will affect you or your customers' welfare as far as my company's policies are concerned, and feel that you will find the same condition of mind existing with all the utility companies with which you may come in contact.

Boiled down, then, my recommendation to you as to how you can be of definite assistance in co-operating with the central stations is

Defend the industry you are interested in against unjust attack from any quarter, and keep everlastingly at it.

Remember that results are not secured by wishing for them but by going out and getting them.

As David Starr Jordan at one time aptly said:

"Only that becomes real or helpful to any man which has cost the sweat of his brow—the effort of his brain or the anguish of his soul—He who would be wise must daily earn his wisdom."

So with co-operative effort. Nothing will come to pass unless we make it. I am sure the central stations will do their share and appreciate and reciprocate anything tangible which you do.



NEWS NOTES



INCORPORATIONS.

SEATTLE, WASH.—Patent rights have been issued to P. J. Healy on a water tubular locomotive boiler constructed entirely of tubes. For the purpose of manufacturing, selling and installing this boiler a company has been organized under the laws of the state of Washington to be known as the Healy Boiler Company of the United States of America, with head offices here. Capitalization is \$15,000,000. The officers of the company are, F. A. Belyon, president; F. J. Healy, vice-president; and W. R. Houghtling, secretary and treasurer.

SANTA FE, N. M.—Attorney Francis E. Wilson has filed articles of incorporation of the Rio Grande Light, Heat & Power Co., with headquarters in Santa Fe, and capitalization of \$1,000,000, for the development of power from the waste water in White Rock canyon. The incorporators are Daniel L. Evans, Pottstown, Pa.; Chas. L. Wilfong, Haddon Heights, N. J., and James Morrison of Baltimore; F. C. Wilson, statutory agent. The power plant is to be erected on Sandoval side of the canyon, just above Cochiti.

SALMON CITY, IDAHO.—Articles of incorporation have been filed by the Salmon River Light & Power Company. The officers are: President, C. L. Mackenzie; vice-president, H. H. Boomer; secretary, W. A. Monroe; treasurer, R. Irvin; general manager, E. Riggs. Arrangements have been made with the Spokane & Eastern Trust Company of Spokane to float a bond issue of \$125,000. A local bank has taken \$25,000 of these bonds. The Lemhi Power Company has transferred all its holdings in this county to the new organization. The new plant will be modern and complete and will furnish enough power for present and future needs. The Gilmore mines will use some of the new power, and this also will be furnished to the new gold dredge to be built near town. The building of this plant will give a great impetus to local business conditions. Contracts for the work will be let as soon as the necessary estimates have been made.

ILLUMINATION.

KELLOGG, IDAHO.—The council has ordered lights installed in the Industrial Union Park.

WALLACE, IDAHO.—J. B. Ingersoll has presented a proposition for street lighting to the council.

ANACONDA, MONT.—The council has passed an ordinance to open, pave and light Commercial avenue.

SAN JACINTO, CAL.—A. S. Dudley is trying to interest capital in a proposition to bring natural gas at Brownlands to San Jacinto.

SEATTLE, WASH.—An ordinance was introduced at the meeting of the council last Monday directing the issuance of \$404,000 light and power bonds.

LOS ANGELES, CAL.—Bids will be received up to August 24th, for installing and maintaining an addition to the street lighting system in the Lankershim lighting district.

CHEHALIS, WASH.—B. F. Walling has been granted the right to construct and operate electric light lines for transmitting electric power in the roads and streets of this city.

SEATTLE, WASH.—The state public service commission has passed a decision compelling the Seattle Lighting Company to extend its gas service to the residence of Benjamin E. de Roy, West Seattle.

ESCONDIDO, CAL.—The Escondido Utilities Company has sold its light and power plant to O. E. Freeman and Frank C. Woodworth. Mr. Freeman will take over the management at once. The system will be improved by the new owners.

LOS ANGELES, CAL.—Preparations are being made for the illumination of Long Beach boulevard from Huntington

Park to the ocean front. Huntington Park has already raised funds to finish its part, and also to provide electroliters along Slauson avenue west.

AUBURN, WASH.—At its regular meeting of this week, the city council granted a franchise to the Auburn Gas Company, represented by J. L. Veach of Auburn. Contracts will be let at once for a modern gas plant at a cost of between \$40,000 and \$60,000. The franchise limits the price of gas to \$1.40 per M cu. ft.

LOS ANGELES, CAL.—Installation of a comprehensive system of incandescent lighting in the city parks is proposed to meet the requests of the Juvenile Protective Association and the police department for measures to prevent immorality in the parks. The council has called on the city electrician for an estimate of the cost of such a plan.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company granted a 50 per cent discount from its regular cooking rate to company employees effective August 1st so that hereafter its employees may enjoy a rate of 2c per kilowatt hour, subject to a 10 per cent discount for prompt payment and a minimum charge of \$1.00 per month for all electrical energy used for heating and cooking purposes.

SEATTLE, WASH.—The board of public works has awarded the contract for furnishing the city with electric lamps to the Pacific Lamp & Supply Company for \$80,000. The contract for 80 8 pin cross arms to the Western Electric Company, 0664.20. The contract for twenty police boxes to the Dean Electric Company, \$73 each, and the contract for oil pumps for the steam electric plant to the Dean Steam Pump Company, \$2655.

TRANSMISSION.

SALEM, ORE.—The Kless Electric Company has completed filings for 200 h.p. on Mill Creek, a tributary of the Grand Rende River, for supplying the Summerville Union Company.

TACOMA, WASH.—Bids are being taken for supplying material for the construction of an electric transmission line from the city limits of Tacoma to the limits of the town of Steilacoom.

WINLOCK, WASH.—The Independent Electric Company, a subsidiary of the Washington-Oregon Corporation, has completed the survey for the extension of its power line from Winlock to Toledo.

HOOD RIVER, ORE.—August Guigard has completed filings with the state engineer, Salem, for development of 2000 h.p. on Hood River for the establishment of a general electric plant to supply farmers in the vicinity.

RIDDLE, ORE.—The Oregon-California Company will construct an electric power line into Riddle and Canyonville. The estimated cost of putting the line from terminus at Fernvale through Riddle to Canyonville is \$40,000.

JUNEAU, ALASKA.—The Alaska Light & Power Company has stretched cables across Gastineau channel at the narrows formed by the Gold Creek estuary, and is furnishing electric light and power to the residents of Douglas Island.

SQUAMISH, B. C.—The Pacific Great Eastern development scheme is being rapidly carried along. They are waiting for special machinery now being made that the falls on the west side of the Squamish may be utilized. This power will be used for dredge work of the harbor and river bed.

CARPINTERIA, CAL.—The Holton Electric Power Company is to make this point the center of operations for the northern part of the valley, and plans are under way for the erection of a transformer station at once. G. B. Fairbanks, constructing engineer for the company, is preparing to begin work.

SANTA BARBARA, CAL.—The supervisors have instructed the county clerk to notify all telephone, telegraph, power and other companies in this county, using wires and poles along the county road, that the board will, on September 8th pass an ordinance providing that all power wires be strung on one set of poles on one side of the road, and all non-power lines on another set of single poles on the other side.

LOS ANGELES, CAL.—The aqueduct power bureau has asked the city council for an additional loan of \$2000 to carry forward work on the power project for the month. The council had previously loaned the bureau \$116,000, to be repaid from the money to be derived from sale of power bonds. The finance committee is to pass upon the request for a further loan. It is also planned to begin construction on the dam which is to form the Long Lake reservoir.

LEWISTON, IDAHO.—The practicability of a dam across the Clearwater River at this point is being investigated. The committee reports that the land owners whose property would have to be used in the construction of the dam, offered the land to the city if they would grant the use of the 100 h.p. of electricity for a period of 50 years. An effort will be made to get data in such shape that the issuance of bonds for the construction of the dam here can be submitted to the voters at an early date.

SAN FRANCISCO, CAL.—U. S. District Judge Van Fleet, Acting U. S. Attorney Thomas H. B. Dechand, assistant solicitor in the Department of Agriculture, and W. B. Bosley attorney for the Pacific Gas & Electric Company, left for the mountains last week to take a view of the land involved in the suit of the company against Secretary of Agriculture Houston. A motion to dismiss the action made by the government is pending before Judge Van Fleet. The company sued for an injunction restraining the United States from interfering with a water aqueduct that runs across the Tahoe national forest for about half a mile. The aqueduct is part of the Lake Spaulding power system.

TWIN FALLS, IDAHO.—The Public Utility Commission of Idaho commenced a hearing in Idaho Falls last week to consider the three-cornered fight which is now being waged for the control of the southern Idaho power territory. The Idaho Power & Light Company and the Clear Lake Power Company are seeking to enter this territory in competition with the Great Shoshone & Twin Falls Water Power Company. Mr. P. N. Nunn, consulting engineer for the Idaho Power & Light Company, was one of the principal witnesses before the commission. He is of course in favor of competition and took up extensively the subject of heating by electricity which he pronounced a luxury rather than a necessity and advisable only pending the adoption of electricity for more profitable purposes. In this he attempted to weaken any evidence produced by the Great Shoshone Company based on the distribution of electricity for heating purposes. The Great Shoshone Company is seeking to show that the Idaho Power & Light Company is not an independent concern, that it is controlled by the Idaho Railway, Light & Traction Company of Boise, which in turn is financed by large New York banking interests. Mr. Nunn's testimony would seem to indicate that such is the case; also that there is a possibility of consolidation of all of the power interests in southern Idaho not including the Great Shoshone Company.

TRANSPORTATION.

CLOVIS, CAL.—The board of trustees has authorized the offering of another street railway franchise through the town at public sale on September 8th.

SNOHOMISH, WASH.—The Commercial Club has voted in favor of asking Interurban Railway to extend line from the Northern Pacific depot to down town district.

PORTLAND, ORE.—The Portland & Oregon City Railway Company will accept a franchise for an interurban line on the

east side to connect with a new line being built from Oregon City to Portland.

DIXON, CAL.—The Sacramento Valley Electric Company has been granted permission to enter this town under a one-year franchise granted by the city trustees. A depot will be built west of First street.

MILWAUKEE, ORE.—The application of L. H. Campbell of this city for a 25 year franchise to maintain railroad tracks and operate cars, and to construct power, telephone and telegraph lines in Milwaukee as amended by the public utilities committee will come up before the city council shortly.

SAN FRANCISCO, CAL.—The Van Ness avenue municipal railway line was completed by Mahoney Bros. within the time limit entitling them to the \$15,000 bonus offered by the city. On August 15th an informal opening of the new municipal line will take place, cars being run from Market street to the Exposition grounds.

SPOKANE, WASH.—Judge Bruce Blake is hearing arguments of the attorneys of the Spokane Inland Empire system and the state public service commission in the case started by the commission in an effort to force the company to file a schedule of its power rates. The company seeks to prove that the sale of power to consumers is a private transaction and that it is a purchaser of power from the Washington Water Power Company.

BENICIA, CAL.—Engineers for the Benicia Land & Terminal Company have started surveying for the proposed electric railroad between Benicia and Vallejo. The outfit is in charge of Chief Engineer Matthews. President A. D. Bowen and Wm. Sanford of San Francisco have been here making arrangements. The franchise over streets in Benicia and Vallejo will probably be asked for in the near future, but action upon a county franchise must wait upon the surveys.

SAN FRANCISCO, CAL.—Action on the construction of the Church street municipal street railway has been deferred indefinitely by the supervisors on advice of City Engineer O'Shaughnessy, who argues that the proposed railway should be constructed as a unit when the entire route could be determined, and not before. Supervisor Power's motion called for immediate building of the road from Van Ness avenue, by way of Market and Church streets, to the hill at 18th street, leaving the determination of the route from that point to Twenty-second and Church streets for the future.

SACRAMENTO, CAL.—Arrangement has been made by the Northern Electric Railway Co. with the Santa Fe to handle transcontinental business from all points served by the electric company in the Sacramento Valley. The routing of this business will be: Northern Electric to Sacramento; Oakland, Antioch & Eastern at Bay Point and Santa Fe beyond or Northern Electric to Sacramento, Central Traction Company to Stockton and Santa Fe beyond. In addition to the above the Northern Electric is now arranging for joint rates in connection with these roads on interstate business. The Northern Electric has previously arranged to handle transcontinental business in connection with the Southern Pacific Company and the Western Pacific Company.

VANCOUVER, B. C.—As it is probable that a number of the employes of the transportation department of the B. C. Electric will be called upon for service in the army or navy, the company has decided to do everything in its power to enable the men to perform military service as may be required without disadvantage to their connections with the company. A notice will be posted by the transportation department stating that where men apply for leave of absence to enter service during the war now in progress, the company will, as far as possible, keep their places open for them and arrange that their absence shall not disturb their seniority rights. One of the transportation employes has already made application for leave of absence to engage in military service and in considering this case it was decided to adopt the general rule above noted.

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BY M. M. O'SHAUGHNESSY.

COMPARISON OF STEAM AND DIESEL UNITS.

STANDARDS IN SAN DIEGO.

BY L. M. KLAUBER.

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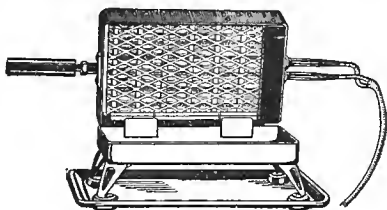
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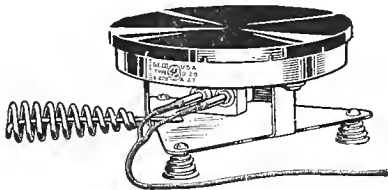
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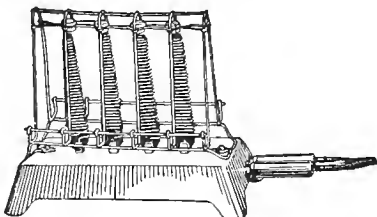
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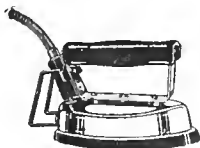
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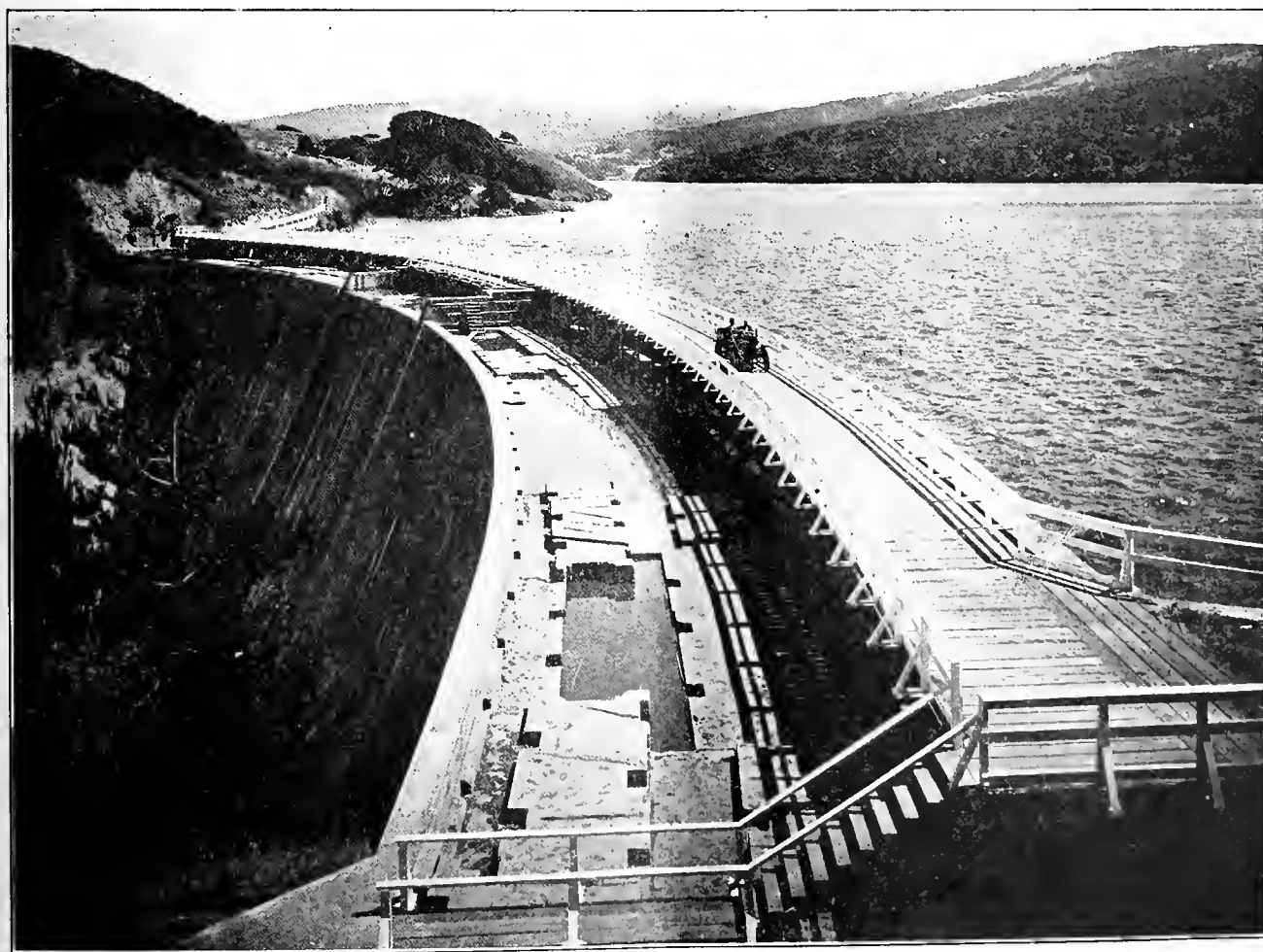
THE WATER SUPPLY OF SAN FRANCISCO

BY M. M. O'SHAUGHNESSY.

(This timely article reviews the past history of San Francisco's efforts to obtain a municipal water supply and explains the means by which it is now proposed to accomplish this purpose. It is based on a talk recently given before the Engineers' Club of San Francisco. Mr. O'Shaughnessy is City Engineer for San Francisco.—The Editor.)

The city of San Francisco has been wrestling with the water problem since 1873 when they first attempted to acquire the supply then owned by the Spring

There are many difficulties attending the supply of water to a city situated as San Francisco is, at the head of a very narrow peninsula to which water must



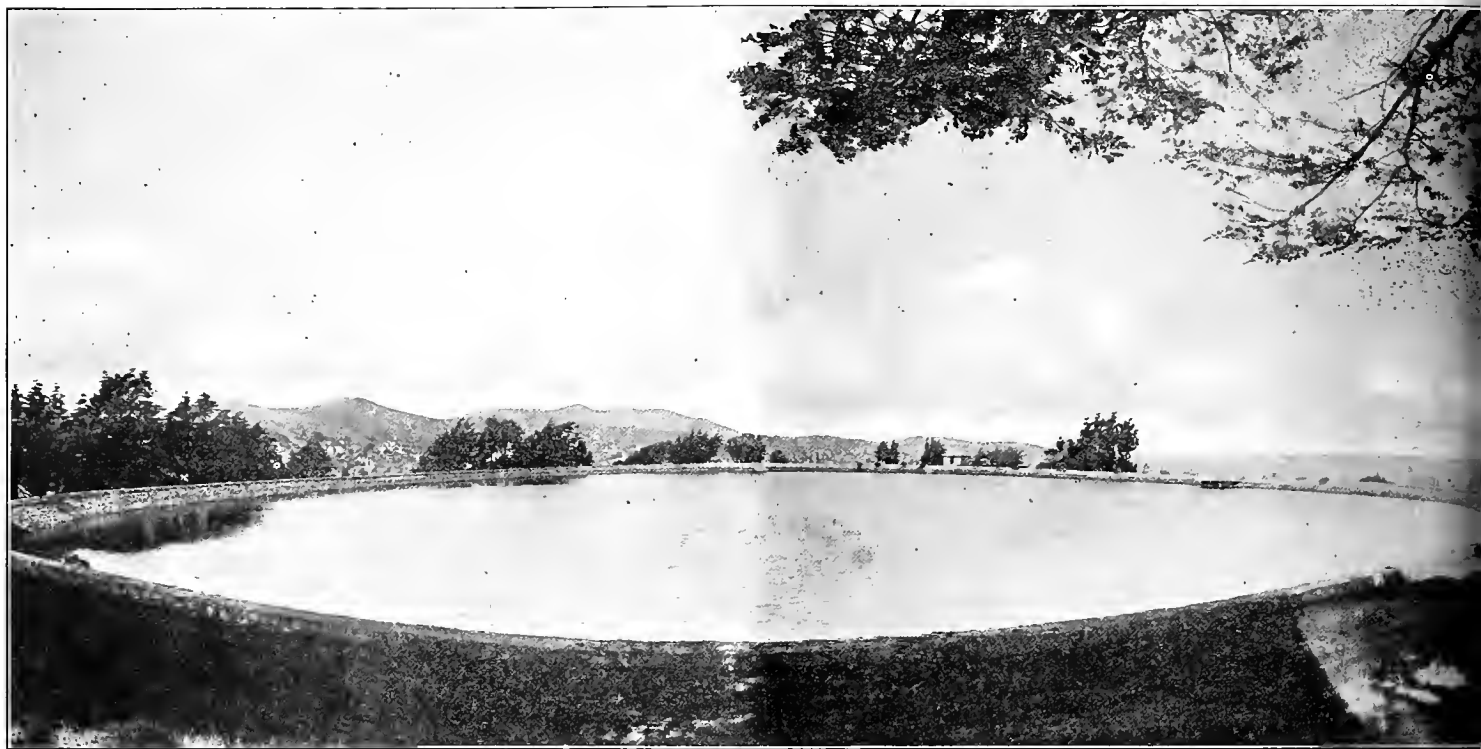
Crystal Springs, Dam, Owned by Spring Valley Water Company.

Valley Water Company. Various efforts have since been made to acquire this property and the present city administration, headed by Mayor Rolph, has been endeavoring for two or three years to place the acquisition of the Spring Valley Water Company's system before the citizens.

be brought a considerable distance. Possibly the only other city comparable with San Francisco, and confronted with the same physical conditions, is New York, which is also at the head of a narrow peninsula. But New York is fortunate in having in its immediate vicinity a country with an average annual rainfall

of 45 in., whereas the average rainfall in San Francisco is less than 22 in. and therefore the conservation of large bodies of water in storage reservoirs to overcome dry periods is an imperative necessity in San Francisco. This condition, of course, also makes the delivery and distribution of water more expensive, the retail prices of water in San Francisco now averaging about \$.21 a thousand gallons. This compares favorably with New York where the retail rates are \$.16 a thousand gallons and where so far, they have gone only a comparatively short distance to get the pres-

The city, however, never lost sight of the necessity of acquiring a water supply. San Francisco is the only large city in the United States, with the exception of Denver, which does not own its own water supply. A city may get along without gas and electricity simply by using candles and coal oil lamps for light and wood and coal for fuel. If citizens do not like the street car system they may walk. But everybody needs water and the conservation of the water supply of a city is the most important duty of the citizens. The authorities are duly impressed with



College Hill Distributing Reservoir.

ent supply of 350,000,000 gallons per day. They are now constructing works 100 miles long to the Ashokan system to get an additional 500,000,000 gallons per day.

Up to the time of the earthquake and fire, San Francisco was possibly the most prosperous municipality in the United States, having practically no bonded indebtedness. It, however, owned no public utilities such as a water supply, street railways, municipal docks or wharves, its only properties being schools, fire and sewer systems. Since that catastrophe, the city has been compelled to incur the enormous outlay of possibly \$25,000,000 to \$30,000,000. Restoring the destroyed streets cost about \$8,000,000, restoring the sewer system and school and fire houses; purchasing a civic center; building a city hall; and constructing the high pressure fire fighting system, which cost \$6,000,000 and is acknowledged by all critics to be the best in the world. This burden has been heavy and besides the catastrophe of fire and earthquake San Francisco also had the misfortune of being run by an undesirable lot of politicians, so that a house cleaning has had to take place, causing with factional conflicts a still heavier burden on the city.

the great importance of solving this question, and besides making provision for the future water supply they are also endeavoring to make provision for the present immediate water supply. Considerable information on the general water problem can be had from the Freeman Report, and the author's report on City Wells.

Since the new charter of 1900 when water rates were reduced, the Spring Valley Water Company has made little extension to its system. It has ceased laying large distributing pipes through the city and the pipes now laid in the outlying district are less than 2 in. in diameter. In some portions of the city due to lack of water pipes, the condition is serious, such as in the Richmond section where a population of 40,000 people is fed by one 16 in. pipe. There are miles and miles of asphalt streets in that section with property worth hundreds of dollars per front foot dependent on one water service pipe. There are always two sides to every question. The claim of the citizens is that the water company has been charging too high rates. The water company's contention is that they have not been getting enough revenue; and possibly, there is always a middle ground which is the right ground, but

the practical result of this controversy compels the rate payers to pay the burden of legal expense annually incurred over rate contests.

In Washington last year, when the city's representatives were appealing to the national government to give the city the Hetch-Hetchy grant for a future source of supply, assurances were given Congress by the city officers that we propose to acquire the

Valley to agree to accept \$34,500,000 for all the properties described in this condemnation suit. This is about \$3,000,000 less than the price last demanded by the company. The company then asked \$37,500,000, about eighteen months ago, and the city offered \$37,000,000. Since that offer, about 30,000 acres of land have been excluded and the Spring Valley offered a portion of it to a water company in San Jose for about



Lake Honda Reservoir.

Spring Valley system. In pursuance of this policy, condemnation suit was filed against that company last December to acquire all of its property that was necessary and useful in connection with a future Sierra supply.

With that end in view, and during the six months of last year I compiled a report at the request of the supervisors, delineating all the properties that were necessary for a municipal supply, and that included about one thousand acres of land in the city and county of San Francisco, and about 67,000 acres outside of the city. This list includes 823 acres around the shores of Lake Merced, and the latter, together with eleven other reservoirs shown on the various maps comprises the service reservoirs within the city. The list also includes all the lands, rights of way, pumping plants, and reservoirs in the country and are useful for a future supply. Certain lands have been excluded, such as the Coyote Creek and Searsville, which are positively of no value to the city, and the effect of excluding those lands has been to lower the purchase price of the Spring Valley properties so that the attorneys for the city were able to get the attorneys for the Spring

\$150,000, but it is absolutely of no value to San Francisco for a future water supply.

Sixty-seven thousand acres of land outside of San Francisco has very substantial value—possibly \$100 an acre is a fair average to put on it. Some of the lands inside of the city, such as the Ingleside tract of 43 acres, is worth at least \$3000 an acre, as well as the sites of the University Mound, Holly Park, and Laguna Honda Reservoirs, so that the lands which the city is acquiring are of a very substantial value.

At the present time the water system is developed up to forty million gallons per day. About twenty million gallons is taken from the peninsula system of San Francisco, comprising the three reservoirs of Crystal Springs, San Andreas, and Pilarcitos with a combined capacity of thirty millions of gallons. The Crystal Springs dam can be increased at a moderate expense to nearly double its reservoir capacity by raising the dam about 50 ft. in height. The constructed portion of the dam is of sufficient base to be able to stand that raise without any great expense. The capacities of Alameda, Pleasanton, Calaveras and San Antonio sources are now twenty million gallons daily.

At the present time the company has under construction a hydraulically filled dam at Calaveras intended to be 200 ft. high. The base is about 1310 ft. wide and is now constructed, and an outlet culvert 20 ft. in diameter has been built to carry away the freshet waters so that the dam will not be destroyed during construction. The city practically assured the company a return on this item of outlay provided they went ahead and built this dam. About a year ago last August the Spring Valley started and made good progress until about January or February of this year. Since that time they have been proceeding slowly, due perhaps to the condemnation suit. If this proposed purchase is agreed upon the Spring Valley will probably proceed actively with the construction. Naturally, they are a timid corporation, susceptible to external influences. With the completion of the Calaveras dam, that reservoir with a capacity about equal to the combined capacity of all the three peninsula reservoirs, nearly thirty billion gallons, will add to the present supply about twenty million gallons a day more; so that with a comparatively moderate expense at least twenty-five million gallons per day can be taken out of the undeveloped portions of the Spring Valley.

The revenue list of 1912-1913 shows that the total revenue of the Spring Valley was \$3,292,000, operating expenses \$840,775 and taxes \$116,000, making a total of \$1,221,000, which makes a net revenue of \$2,071,000 to meet interest on bonds, stock dividends, and depreciation. At \$34,500,000 the proposed purchase price, on a basis of $4\frac{1}{2}$ per cent the interest charge would be around \$1,552,000 yearly, and deducting that from the net of \$2,071,000 would leave \$518,000 for a profit, including the depreciation. The depreciation may safely be estimated to be \$250,000 to \$300,000 a year on a plant of this magnitude, so that even at the present prices from the present figures and under city administration I believe a small profit can be made at the present sale price. I figure about \$218,000 a year.

The entire distributing system of Spring Valley inside the city is about 568 miles, of which 424 miles, or 74 per cent is cast iron pipe which has been in for 22 years, 11 per cent is wrought iron riveted pipe which has been in for 27 years, and 133 miles small pipe with an average of 10 years, which confirms my statement that the policy of the Spring Valley for the past ten years has been to put in very small pipes so as to get the commodity to the consumer at a minimum of expense and defer capital expenditure for larger pipe. Of course, this situation would be changed under a city ownership, as the city would put in pipes of a larger diameter, none less than 6 or 8 inches, and map out a more generous policy toward consumers.

There are two alternatives at hand for the city. One is to buy Spring Valley and the other is to cease all negotiations and go ahead at once with the complete construction of the Hetch-Hetchy system. All estimates, including Mr. Freeman's, figure about \$40,000,000 to the city boundary line and with the necessary distributing reservoirs, land, pipe lines, and pumping stations, inside the city, will cost \$12,000,000 or \$14,000,000 more, making \$54,000,000 or \$55,000,000 for the water supply and its delivery to the consumers in the city, exclusive of interest during construction.

If this alternative is adopted the city will have to pay interest on the entire \$55,000,000 until the day of first delivering water. Eighty thousand taps now exist and the change from the private company to the public company will be slow and prolonged and there will be a tremendous economic waste during the transition.

The policy of the city administration is, however, a broad one; and it is endeavoring to solve this question on its business merits and treasure no resentment on account of past controversies.

The plan is to acquire the company for about \$34,500,000, spending about \$8,000,000 on the completion of the Calaveras dam and advancing construction towards the Hetch-Hetchy system, reducing the total cost and gradually developing the present system. Forty millions of gallons is to sixty-five millions of gallons as \$3,200,000 is proportioned to \$5,200,000 so that the purchase of this system on this plan and developing it progressively, using receipts from sales of water, will make no burden on the taxpayers of San Francisco. In the meantime the city will proceed to develop the mountain water supply, build the Hetch-Hetchy dam, twenty miles of aqueduct and develop 30,000 h.p. as a first unit of hydroelectric power which will help to operate municipal railways. The whole purpose of this policy is to keep the tax rate down and help acquire other public utilities and proceed in a sound and reasonable manner with the financial policy of the city.

The tax rate in San Francisco is \$2.30 on a fifty per cent valuation; Los Angeles, \$3.19; Oakland, \$2.97; San Diego, \$3.95; Sacramento, \$4.17; Pasadena, \$3.90; Stockton, \$4.04. In fact, the tax rate of San Francisco is but one-half of what it is in the other cities of the state. This will show that, notwithstanding our political administration, San Francisco is handling its business matters in a sound manner.

A world's record in freight haulage is claimed to have been set by the new "centipede" locomotive of the Erie railroad which pulled 250 fully loaded cars at the rate of 15 miles per hour. The locomotive weighs 410 tons and has 24 driving wheels.

California's hydroelectric power development ultimately possible is estimated at six and one-half million horsepower, three-fourths of which lies within the national forests and is consequently subject to federal control. Of the half million horsepower already developed more than one-third of the developments have conduits or power house sites entirely or in part on government land within national forests.

The Oregon Hydroelectric Commission's request that the U. S. Consular service collect data concerning the development of foreign hydroelectric enterprises, has been granted. H. B. Miller, chairman of the commission, has received copies of a letter being sent to all American consular officers. The outline calls for detailed reports of equipment, costs, operating statistics, rates, power uses, and government ownership and control.

COMPARISON OF STEAM AND DIESEL UNITS.

(The comparative data in this article were brought out in an investigation of the Arizona Corporation Commission into the advisability of allowing the Bisbee-Naco Water Company to issue notes to pay for a Diesel engine electric installation to replace steam pumping units.—The Editor.)

The equipment now installed at the Naco pumping plant of the Bisbee-Naco Water Company consists of steam boilers, triple expansion high duty steam pumps, Prescott duplex steam sinking pumps, Diesel type oil engines, quintuplex high duty surface pumps and triplex deep well pumps; the Diesel engines being direct connected to the generators and the quintuplex and triplex pumps motor driven. The Prescott steam sinking pumps are rarely operated, but are held in readiness for operation. The steam sinking pumps are not prime operating units since they are not used normally when other steam units are in service. Consequently this equipment may be divided into two general classes—steam operating equipment and Diesel oil engine equipment.

The duty required of the plant consists of pumping water from wells to surface reservoirs and pumping from surface reservoirs to the several storage tanks in and around the cities of Bisbee, Warren, Lowell, Naco, Arizona, and Naco, Sonora.

Since the operating equipment may be divided into two general classes and the functions to be performed into the same, an analysis of operating costs resolves itself into the following:

1. A determination of the amount of work performed by each of these classes of machinery.
2. Ascertaining the unit cost of such work.
3. A comparison of the efficiency of these classes as installed at this plant.
4. Recommendations relative to improving efficiency and reducing operating costs.

In such analysis it is necessary to tabulate and arrange the records of past operations, using the best data available, and in all cases the greatest period of time applicable and presented in evidence herein will be used.

Work Done by Each Class of Equipment.

The data available for this consideration is that shown in the reports from April 1st to November 1st, 1913, tabulated below:

Tabulation of Hours Operating for Steam and Diesel Classes From April 1st to November 1, 1913.

Month.	Operating.		Per Cent.	Diesel Hours.	Per Cent.
	Total Hours.	Steam Hours.			
April	720	121	16.8	599	83.2
May	744	26	3.5	718	96.5
June	720	105	14.5	615	85.5
July	744	189	25.5	555	74.5
August	744	16	2.4	728	97.6
September	720	20	2.8	700	97.2
October	744	10	1.4	734	98.2
November	720	95	13.0	625	87.0
Totals	5856	582		5274	
Average	732	72.8	10.00	659.2	90.0

From this, it is observed that the steam units were in operation ten and the Diesel units ninety per cent of the total time. It has been represented that the above time period does not cover the months for general repairs of the Diesel units for this year, this being done twice a year and being for a longer period than any shown in the tabulation. Considering the time

covered in the tabulation as compared with the total life of the Diesel units, the tabulation covering but a small part of the life of the Diesel equipment, the commission feels that the percentages as here given are above the normal for the life of these machines, and for this item uses 14 per cent for time of steam units operating and 86 per cent for time of Diesel operation, or 314 days Diesel operation and 51 days steam operation per year.

Unit Cost of Work Done by Each Class of Equipment.

The large items entering into a consideration of the unit costs of operating these classes of equipment are:

- Fuel operating;
- Labor operating;
- Labor maintenance;
- Material maintenance.

From the reports made at this plant, and under the system of accounting in vogue prior to the uniform classification of accounts for water companies issued by this commission, it has not been possible to secure many data regarding the cost of any of these items excepting fuel cost.

However, from a study of these reports and the conditions at the Naco plant relative to labor required and material used when operating either class it appears that the labor operating cost is not materially altered by a change from one class to the other, nor is there a material increase or decrease in the two last items when changing from one class of operating units to the other.

For these reasons only fuel costs will be considered for unit cost of operation, it being found that a large part of the difference in the cost of operating these two classes of machinery is in the fuel item.

To arrive at such unit cost of operation, it was necessary to tabulate the total oil consumption, showing the amount and percentages used by each class per year. This table follows and covers a period of 4-5/12 years:

Tabulation of Oil Used for Steam and Diesel Operation From July 1, 1909, to December 1, 1913.

Year.	Total Gals. Used.	Boilers, Gals.	Per Cent.	Diesel Gals.	Per Cent.	Remarks.
1909.....	50,767	16,729	33.0	34,038	67.0	Last ½ yr.
1910.....	114,846	48,227	42.0	66,619	58.0	
1911.....	139,167	87,846	61.4	53,321	38.6	
1912.....	414,270	358,944	86.6	55,326	13.4	
1913.....	290,224	229,118	79.0	61,606	21.0	1st 11 mos.
Totals	1,009,774	738,864		270,910		
Averages, 4 5/12 years	227,083	167,158	73.8	61,292	26.2	

The percentages of fuel oil used by these two classes of equipment for 4-5/12 years were: For steam 73.8 per cent and for Diesel 26.2 per cent.

Considering the condition of the oil market at this time and the ascending cost of this commodity during the last five years, the present price of four cents was assumed for oil. In such instance the total cost of fuel per year for the two classes, from the above average, was:

167,158 gals. @ 4c. per gal.—For steam operation,
 one year\$6,686.32
 61,292 gals. @ 4c. per gal.—For Diesel operation,
 one year\$2,451.68

For the cost per unit of work done, referring to the percentage of work performed by each class, \$6686.32

is cost of 14 per cent, and 1 per cent of power made by steam units is \$477.60: \$2451.68 is cost of 86 per cent, and 1 per cent of power made by Diesel units is \$28.51. This gives a ratio of fuel efficiency of Diesel to steam units of 1 to 16.75.

This is much above normal for these two classes and is caused by the heavy repairs to wells in 1912 and construction during the early part of 1913. For this reason, considering the most favorable year regarding fuel consumption thus:

48,227 gals. @ 4c. per gal.—For steam operation,	
1910	\$1,929.08
66,619 gals. @ 4c. per gal.—For Diesel operation,	
1910	\$2,664.76

And using the same percentages of time operated or duty performed, \$1929.08 is cost of 14 per cent, and 1 per cent of power made by steam units is \$137.74; \$2664.76 is cost of 86 per cent, and 1 per cent of power made by Diesel units is \$30.98, thus giving a ratio of fuel efficiency of Diesel to steam units of 1 to 4.45.

Averaging this ratio for the best year with that obtained for 4-5/12 years, the ratio of fuel efficiency of Diesel to steam units at this plant is 1 to 10.6, which is above the ratio obtained in other plants operating modern steam and Diesel units. Considering the fact that some of the steam equipment is inefficient and not to be compared with present manufacture, and considering carefully the testimony and evidence presented the commission believes that a safe ratio of efficiency for steam and Diesel units of this plant under careful operation to be as 1 to 8. Accordingly this calculation was used.

Comparative Annual Cost of Operating.

From an investigation of the amount of oil used per day under boilers during 1913, it was found that the average daily consumption of oil per boiler has been 750 gallons. It was also ascertained that during the operation of boilers for the period, one and one-half boilers were used for the total time of boiler operation. This gave a daily oil consumption for boilers of 1125 gallons, which for 14 per cent of one year, or 51 days, gave 67,375 gallons, costing, at 4 cents per gallon, \$2695.00. To this add the cost of packing the surface steam pumps, which was often above normal on account of hardening during non-use, this cost per year being \$252.

From the total of above items, deduct the cost of fuel oil for 51 days for Diesel operation, which from data for the year 1913 was one-eighth of steam, or \$336.80. Or recapitulating:

Cost of fuel for 51 days of steam operation,	\$2,695.00
Cost of packing steam pumps, excess of normal	252.00
Cost of fuel oil for Diesel operation, 51 days at 1/8th of steam	\$336.80
	<hr/>
	\$2,947.00 \$336.80

This demonstrated a saving in fuel operating costs per year, if Diesel units replace steam units 14 per cent of time, of \$2610.20. This saving is in fuel oil for operating only.

One of the most important points for consideration in this report is the effect of the heavy duty required of present Diesel equipment. On account of the low efficiency of the steam units as compared to the Diesel units, a comparatively short period of oper-

ating the former increases the cost of operations at Naco to an extent exceeding the allowance for this particular item, and it has been found necessary on account of such steam costs to operate the Diesel equipment to its limit.

The load is not excessive, but because there is but one large Diesel engine capable of carrying the normal load this engine is operated as near 365 days in the year as possible. It is such continuous operation without small needed repairs that is shortening the life of this machine and will be given consideration here.

It was necessary to operate at Naco 24 hours per day. Twelve hours has been found to be the maximum time that pumps could be idle and maintain a sufficient supply in the service tanks.

Under present conditions, only small repairs could be made on the Diesel engines without firing the steam boilers.

This explained the heavy duty required of the engine, and, in the opinion of the engineers, this continuous operation will shorten the life of the unit at least three years. If this be true, assuming the normal life of this class of machinery to be fourteen years and the first cost \$22,000.00, the loss on this unit due to excessive wear was for the fourteen years prorated, \$1560 per year, and for three years shortened life, \$4680.

This applied to the cost of equipment to replace the steam units, prorating per year using fourteen years as the life of a new engine, would be \$334.30 per year, and should be added to the economies by the installation of another Diesel engine.

A resume of the facts presented demonstrated that by the addition of another large Diesel power unit, a total saving of \$2944.50 can be effected, and the efficiency of the plant increased.

Electric power on the Witwatersrand, South Africa, according to statistics compiled by the South African Institute of Electrical Engineers, aggregates about 220,000 kw. Most of the power is generated at 50 cycles, though several of the mines generate 25-cycle power. Of this amount 43,210 h.p. are required by 406 motors for underground pumping, 21,100 h.p. by 78 motors for underground hoisting, 70,321 h.p. by 112 motors for surface hoisting, 8330 h.p. for stamp-milling, 31,468 h.p. for tube-milling, 47,894 h.p. for cyanide and reduction processes, 30,105 h.p. for electrically-driven compressors, and 2865 h.p. for ore sorting, crushing, haulage, etc. Most of the power is alternating current.

The longest power line in the world is now that of the combined transmissions of the Southern Sierra Power Company and the Holton Power Company. The first extends 238 miles from Bishop Creek to San Bernardino, California, and the other 166 miles from San Bernardino to El Centro, California, a total distance of 404 miles at 140,000 volts. Work has just been completed on the new line, and Sierra power is now being delivered to the Imperil Valley by means of substations at Banning, Coachalla, Calipatria and El Centro.

ELECTRIC DISTRIBUTION

STANDARDS IN SAN DIEGO.

BY L. M. KLAUBER.

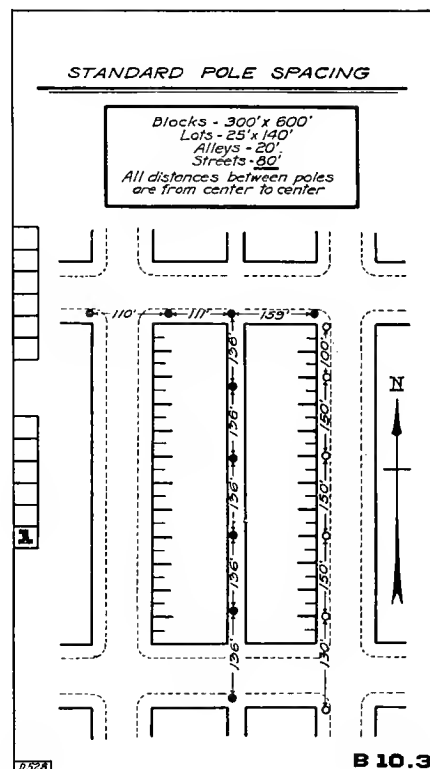
(The second instalment of Mr. Klauber's articles is concerned with pole-spacing and standard materials, including poles, cross-arms, wires and cables, fuses, potheads, iron conduit, anchors and hardware.—The Editor.)

B. Standard Pole Spacing.

Standard block layouts should be made for each district. As can be noted from the typical diagram shown, the data indicated include the size of blocks and lots, the width of alley (if any), the width of street, the pole-distance on north-and-south, and east-and-west streets, and the pole spacing in alleys. This information should be shown for each variation in city layout.

Stakes for poles, in street where curb is not in, are set 14 in. back from future curb line. Stakes set in alleys are placed 12 in. out from property line. All stakes are set in the center of proposed pole position.

Positions of poles under several conditions are shown in diagrams.

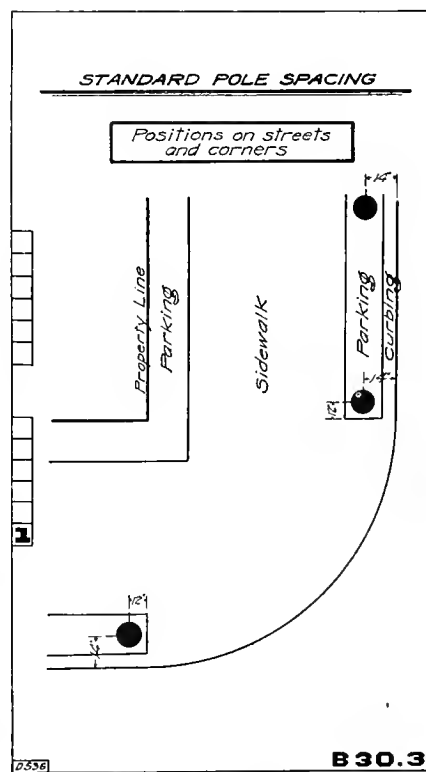
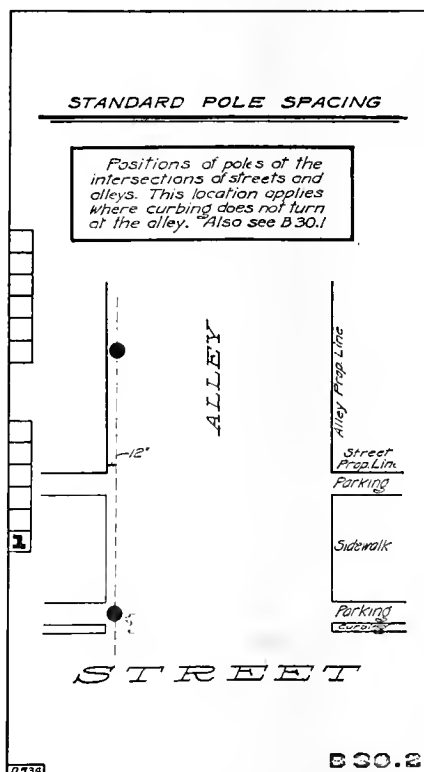
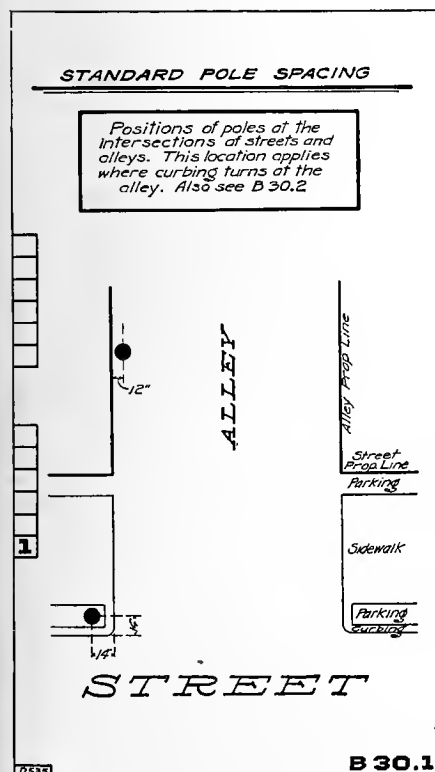


POLE WEIGHTS.

Approximate Weights of Cedar Poles for Figuring Truck Loads.

Length of Pole.	Top, Inches.	Weight, Lbs.
25	6	250
25	7	300
25	8	350
30	6	350
30	7	450
30	8	600
35	6	525
35	7	625

Length of Pole.	Top, Inches.	Weight, Lbs.
25	8	775
25	9	900
40	7	850
40	8	1050
40	9	1200
45	8	1250
45	9	1350
50	8	1500
50	9	1650
55	8	1600
55	9	1800
60	8	1800
60	9	2000



LOW TENSION FUSES
STANDARD SIZES CARRIED IN STOCK

SIZE AMPERES	250 VOLT SERVICE			600 VOLT SERVICE	
	EDISON PLUS CUTOUTS	CARTRIDGE FERRULE	CARTRIDGE KNIFE	CARTRIDGE FERRULE	CARTRIDGE KNIFE
3					
5					
6	•	•			
10	•	•			
15	•	•			
20	•	•			
25	•	•			
30	•	•			
35					
40					
50					
60					
65					
75					
100					
125					
150					
200					
250					
300					
400					
500					
600					

Carried in stock • Ordered as required*
Double Lines enclose groups of like sizes
which will fit the same fuse blocks.

HIGH TENSION FUSES.
STANDARD SIZES CARRIED IN STOCK

SIZE AMPERES	2300 VOLT SERVICE			1000 VOLT SERVICE		
	STANDARD OPEN LINK FUSES FOR TRANS CUTOUTS	CARTRIDGE KNIFE FUSES FOR NOARK BOXES	FUSE WIRE FOR USE IN OIL FILLED SUBWAY CUTOUTS	STANDARD OPEN LINK FUSES FOR TRANS CUTOUTS	SHORT OPEN LINK FUSES FOR LIGHTNING ARRESTORS	
1	•					
2	•					
3	•					
5	•					
8						
10	•	•	•	•	•	
12						
15	•	•	•	•		
20	•	•	•	•		
25	•	•	•			
30	•	•	•			
40	•	•	•			
60	•	•	•			
75			•			
100	•	•				

Dots show fuses carried in stock.
Do not make fuses of large size by twisting
two small ones together.

POTHEADS
STANDARD TYPES FOR USE
ON UNDERGROUND WORK

NO.	TYPE	MFG.	VOLTS	AMPS	CABLE SIZE	FILED	DIS- CONNECTS
10	S	G & W	6600	100		1	Yes
13	S			175		1	
20	TS			600		1	
30	C				600,000	1	No
81	LS				1/0	2	Yes
83	LS				1/0	3	
91	LTS				2 1/2 up	2	
93	LTS				2 1/2 up	3	
391	39	EEE	13200		2 1/2	2	No
371	37				2 1/2	3	
104	10				3 1/2	2	
105	10				3 1/2	3	

NO.	CONSTRUCTION USES
10	2300V Manhole disconnects Branch line
13	" " " Main line
20	" " " Extra heavy
30	Cable Poles 500V DC System
81	2300V Cable Pole disconnects. 2 Pole
83	" " " 3 Pole
91	" " " 2 Pole Heavy
93	" " " 3 Pole Heavy
391	Cable Pole non disconnecting Plant
371	" " " "
104	Interior Service
105	" " " "

CONDUIT DIMENSIONS
STANDARD BLACK ENAMELED OR
SHERADIZED

STAND. SIZE PIPE	INTERNAL DIA. INCHES	OUTSIDE DIA. INCHES	NUMBER THREADS PER INCH OF SCREW	NOMINAL WT. PER FT. LBS.	ELBOWS WT. PER 100 LBS.	COUPLINGS WT. PER 100 LBS.
1/4"	.36	.54	18	.40		
3/8"	.49	.67	18	.53		
1/2"	.62	.84	14	.85	73	15 1/2
3/4"	.82	1.05	14	1.12	132	25 1/2
1"	1.05	1.31	11 1/2	1.67	200	40 1/2
1 1/4"	1.38	1.66	11 1/2	2.24	300	57 1/2
1 1/2"	1.61	1.90	11 1/2	2.68	415	71 1/4
2"	2.07	2.37	11 1/2	3.61	700	132
2 1/2"	2.47	2.87	8	5.74	1133	185
3"	3.07	3.50	8	7.54	1885	300
3 1/2"	3.55	4.00	8	9.00	2100	400
4"	4.03	4.50	8	10.66	2160	412
4 1/2"	4.50	5.00	8	12.43		
5"	5.04	5.56	8	14.50		
6"	6.06	6.62	8	18.76		

CONDUIT TABLE

SIZE OF WIRE	1 WIRE			2 WIRES			3 WIRES		
	SHORT RUN	MEDIUM RUN	LONG RUN	SHORT RUN	MEDIUM RUN	LONG RUN	SHORT RUN	MEDIUM RUN	LONG RUN
14	3/8	3/8	1/2	1/2	1/2	3/4	1/2	3/4	1
12	3/8	3/8	1/2	1/2	3/4	3/4	3/4	3/4	1
10	3/8	3/8	1/2	1/2	3/4	3/4	3/4	1	1
8	3/8	3/8	1/2	3/4	3/4	1	1	1 1/4	1 1/4
6	1/2	1/2	3/4	1	1	1 1/4	1	1 1/4	1 1/4
4	1/2	3/4	3/4	1	1 1/4	1 1/4	1 1/4	1 1/4	1 1/2
2	1/2	3/4	1	1 1/4	1 1/2	1 1/2	1 1/4	1 1/2	2
1	1/2	1	1 1/4	1 1/2	2	2	1 1/2	2	2
0	3/4	1	1 1/2	2	2	2	2	2	2
00	1	1	1 1/2	2	2	2	2	2	2
000	1	1 1/4	1 1/4	2	2	2	2	2 1/2	2 1/2
0000	1	1 1/4	1 1/4	2	2	2 1/2	2	2 1/2	3
300,000	1 1/4	1 1/2	1 1/2	2	2 1/2	2 1/2	2 1/2	3	3
400,000	1 1/2	1 1/2	2	2 1/2	3	3	3	3	3 1/2
500,000	2	2	2 1/2	3	3	3 1/2	3 1/2	3 1/2	4
700,000	2	2 1/2	2 1/2	3	3 1/2	4	4	4	4 1/2
1,000,000	2	2 1/2	3	4	4	4 1/2	4 1/2	4 1/2	5

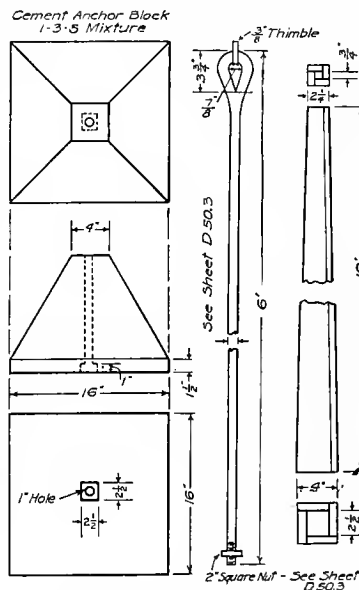
SHORT RUN - Not over 150 ft. and having only for 2 bends
of a radius not less than 3 ft.

MEDIUM RUN - Not over 150 ft. and having not more
than 3 or 4 easy bends; or, 250 ft. long and nearly
straight; or, short run with 1 close and 1 or 2 easy
bends.

LONG RUN - Over 150 ft. with close or medium bends;
or, a run with more than 1 close bend; or, any run
with an extra close bend.

No conduit smaller than 1/2" is permitted
for electric light wiring, but 3/8" noted
above is sometimes used for signal
work.

STANDARD CEMENT ANCHOR,
ROD AND BOX



BILL OF MATERIAL	
1	Cement Anchor
1	3/4" x 6' Anchor Rod
1	10' Anchor Box

Common Wire Nails and Spikes.

Size.	Length, Inches.	Diameter, Inches.	Number Per Lb.
2d	1	.072	876
3d	1 1/4	.080	568
4d	1 1/2	.099	316
5d	1 3/4	.099	271
6d	2	.113	181
7d	2 1/4	.113	161
8d	2 1/2	.131	106
9d	2 3/4	.131	96
10d	3	.148	69
12d	3 1/4	.148	63
16d	3 1/2	.162	49
20d	4	.192	31

Size.	Length, Inches.	Diameter, Inches.	Number Per Lb.
30d	4 1/2	.207	24
40d	5	.225	18
50d	5 1/2	.244	14
60d	6	.263	11

Dimensions of Screws.			
Trade No.	Diameter, Inches.	Nearest B. & S. Gauge.	Greatest Length.
0	7/128	15	3/4
1	9/128	14	1/2
2	5/64	12	7/8
3	3/32	11	1 1/2
4	7/64	9	1 1/2
5	1/8	8	2 1/2

Trade No.	Diameter, Inches.	Nearest B & S Gauge.	Greatest Length.
6	17/128	7	3
7	19/128	7	3
8	5/32	6	4
9	11/64	5	4
10	3/16	5	4
11	13/64	4	4
12	27/128	4	6
13	29/128	3	6
14	15/64	3	6
15	1/4	2	6
16	7/64	2	6
17	9/32	1	6
18	19/64	1	6

ELECTRICAL CONTRACTORS' DEPARTMENT

CO-OPERATING WITH THE ELECTRICAL ENGINEER.

BY F. B. HUNTER.

(After showing the dependence of civilization upon manufactured power, the author shows how the contractor can co-operate with the engineer in correcting the faults now found in specifications. This was presented as a paper at the recent meeting of the California Association of Electrical Contractors at Sacramento.—The Editor.)

Contractors, jobbers, manufacturers, engineers and architects all wish to improve conditions, but progress is hindered in many cases by mutual distrust and by a lack of knowledge of the best way to make the change. A fuller understanding of the relationship of all parties, and a mutual endeavor to help one another will soon pave the way for a better understanding and solution of the problems confronting us.

The present generation has seen the rise of entirely new professions; early in the present age the recognized professions were divided into two classes—military and civil. In civil life, divinity and medicine were the recognized divisions. The demands of advancing civilization have added to these. Engineers were needed to develop, design and "direct the great sources of power in nature for the use and convenience of man," and the contractors to carry out these works and so bring to all the benefits of the new age.

I speak advisedly of a new age as I believe you will all agree that we are now living in a well defined ethnical age. You are all familiar with the epochs marking the progress of the human race from savagery through barbarism to the present day civilization. Man in the earliest period was on a level with the other animals, until by the discovery of fire, the bow and arrow and the art of manufacturing iron he placed himself on a higher plane. Along with this came his ability to domesticate animals and by directing the animal power then at his disposal, supplemented by the use of the instruments of iron, he was able to accomplish greater works than he could before these discoveries. With the invention of the written alphabet primitive man passed from barbarism to civilization, in that he made the work of one set of men available for the study by others and so made co-operation feasible.

Subsequent periods are not so well defined, possibly because they are so close to the present, but through all of this man's accomplishments were limited to his own individual exertions and those of the animals whose efforts he could control and direct. His capacity is now no longer so limited, as he has learned to manufacture power and this marked the beginning of a new period in his history, the one in which we are now living, the age of manufactured power.

I do not believe that we have reached the limits of our achievements in the utilization of Nature's forces. It was not the invention of the first engine, but the general control of manufactured power and its adaption to the needs of man which is now advancing us to a higher civilization. While water wheels, steam engines, in their various forms, and internal combustion engines are the present day sources, new forms

may come at any time. These are, however, relatively unimportant, as the great civilizing force was the ability to manufacture power at all, and the method is comparatively a secondary consideration.

Evidences are already before us of the near solution of the great problem of the control of molecular forces, the forerunner of which is radium and its allied substances. Whether this will mark another epoch in man's development or be merely considered a part of his age of manufactured power will have to be left to future generations. Probably it will be considered only a part of the development of manufactured power and the engines for their utilization will be classed with the water wheels, steam engines and others marking the development of the art. In reality this is only the conversion of another of Nature's great sources of power.

The effect of man's discovery that he could manufacture power is so wide reaching that it is foolish to prophecy. Discoveries in the past may soon be considered trivial in comparison with those to come in the near future. Our problem is to secure for present generations the greatest good from the application of manufactured power which is now, due to our ability to convey it electrically, available at any time and place that may be desired. To secure this result in the most economical way requires co-operation.

The co-operation of the electrical engineer and the electrical manufacturer has resulted in the marvelous development of the present day electrical apparatus. This is not alone confined to the machinery for the conversion of power but extends to the appliances for the use of the power manufactured by our friends of the central stations. This development is not at a standstill by any means and the builders are really only safe when they delay the letting of their electrical contracts until the last minute, if they wish to secure the latest and most improved appliance. In the last six months we have revised the wiring plans of two large buildings in order to take advantage of new devices that were brought to perfection while we were making the original plans. Both of these resulted in large savings in the cost and show the rapidity with which the co-operation of the electrical engineer and the manufacturer is developing new appliances and devices.

We now have the appliances and tools to make the present day homes and places of business more comfortable and convenient than our grandfathers ever dreamed of. Our great problem is to introduce them and to do this in a way to insure their successful and economical installation and operation.

The answer to this is again co-operation, co-operation between the architect, engineer, contractor and manufacturer. The owner through his architect provides in his building for all the conveniences and comforts they know of, but due to the highly complex nature of a modern building, very few architectural offices are equipped to study and keep abreast of the developments in the electrical, sanitary and mechanical fields.

It is unfortunate that many people believe that once a specification has been used for some one build-

ing all that is necessary to do is to change the name of the building as written in the specification and the work for the succeeding ones is done. You are all familiar with the results that follow and usually the contractor is the one to bear the blame because the job cannot be completed without a nice large bill for extras. Many of course do not seriously object to this but I am sure that all of you would rather have a well defined, clear cut, detailed set of plans and specifications to work to rather than the vague, ill adapted and incomplete tools which you get under this system.

This is getting a little ahead of the chronological sequence of events, for your troubles really start before you get the contract. In fact, they begin when you start to estimate the work and make your bid. You know perfectly well what should go in. The question is will your competitor figure on the same thing or will he use something cheaper and hope to have it passed, or will leave out the things that are vaguely hinted at in the specifications and which the architect fondly hopes are covered by some general clause, and so underbid you. These clauses really have no place in a first class electrical specification, but are put in because some fellow years ago used them and so they are retained because they cover a multitude of sins of omissions and give the inspector some grounds for demanding the estimate. Estimating under these conditions is decidedly unsatisfactory to all parties, the contractor loses a good contract if he conscientiously estimates the work as it should be and as the architect would like to have it; the architect loses confidence in the contractor when he finds that he does not get the things that his specifications were intended to cover but did not cover on account of his inability to describe what he really wanted; and the owner joins the architect in condemning the contractor because he has to pay more for his work than his appropriation. The electrical work is not all that is affected in this way and more than one financially sound business proposition has been turned into a losing venture because the bills for extras have so materially increased the cost of the building that the design and plan becomes an economic blunder.

Again we find the very brief specification that tells in a general way that the architect would like to have a certain building wired, and requests that the contractor furnish a plan for his approval. This is placing on the contractor a burden which should not carry and in fact is simply telling him that the architect has a problem beyond his ability to solve and asks for help without being willing to pay for it. What the owner gets under these conditions you are perfectly capable of answering without my telling you, it being, in many cases, simply a matter between your judgment and conscience.

I am very glad to say that these practices are fast disappearing and that the architects are more and more calling into consultation the man who has studied this specialty, the electrical engineer. In this way he brings to his aid the trained mind of the specialist with his accumulation of experience and knowledge and ability to select and determine what best fulfills the needs of each individual case.

The results of this co-operation are beneficial to all. In the first place the owner is receiving the best

available advice as to what will secure the most economical and efficient installation, and the contractor, when the tools, the plans and specifications are turned over to him, has, if the engineer's work has been well done, something definite to work with. A good set of plans and specifications should give him all necessary information for estimating and should eliminate all guessing as to what is really required and expected. These should be carried a step further than they have been in the past and be accompanied by a complete bill of materials, so that all contractors would be estimating on the same basis as to the quantities involved. In this case in all fairness to the contractor and owner unit prices should be required to cover any variations that might develop between the engineer's bill and the quantities actually used in the building. The extra work involved in the preparation of the bill should be paid for by the owner who in reality pays for it under the present system in the form of the contractor's overhead charges. A large per cent of your overhead is made up of the cost of estimating lost jobs and which in most cases is not paid by the proper party.

With a clear cut and definite plan and specification for the contractor to follow the owner secures the best results for the least expenditure, and the contractor knows what he is expected to furnish; he can make an intelligent estimate and if his errors of judgment are small, can be reasonably sure of his profit.

Working under this system the actual installation is certainly more satisfactory, as all differences can be settled by reference to the plans and specifications.

The change to this is slow, it being hard to convince owners and architects that the engineer's fee is a good investment and one that is in the majority of cases more than offset in the increased efficiency of his installation and the reduction in the actual cost of the work.

You as contractors can not only materially improve the business as a whole but also raise the standard of your specialty by co-operating with us in our endeavor to convince the owners and architects that their interests are best served when the equipment is designed by an engineer. We will not then have the spectacle of the engineering department of a public service corporation refusing to give service on the grounds that the installation is so poor that they are afraid to connect up to it.

A very convincing argument you can use immediately is to refuse to prepare plans and specifications unless they are paid for on a regular professional scale of fees. By adopting this suggestion you will again be able to reduce your overhead charges. You are not fair to one another when you carry on an engineering business under the guise of contracting and I am sure the owners, once they see that they are not getting something for nothing, would feel that they were securing better results by the employment of an engineer, as no matter how ably or honestly the work is done, there will always be the feeling that there is somewhere a clause or provision favoring the man who did the work.

Our friends, the jobbers and manufacturers, are not free from criticism in this matter, as in order to secure the introduction of their special apparatus or appliances they will usurp the function of the engineer

and prepare plans and specifications; many times the resulting installation is not the one best suited for the particular case, and the contractor again has to bear the blame for something for which he was not at all responsible. The manufacturer who will say "John Smith's appliances will better suit your needs than ours, and I advise you to see them," is rare, but I take great pleasure in stating that many times within the last few months I have personally had this experience, when apparently the products were identical.

The manufacturer and jobber need not be afraid that his material will not be given careful consideration by the conscientious engineer, who is endeavoring to do good work. He is the man best fitted to say what should be used, as he can study and compare the various products presented for his consideration and has the whole manufacturing field to draw from. Let the engineer weight the evidence presented and after a careful analysis decide what he wants and then you as contractors give it to him. Ask for substitutions, only when the products are comparable. Of course from the salesman's point of view, his product is as good as the other fellow's, but from an engineering viewpoint there may be a vast difference. I endeavor to consider everything presented and select that which I believe to be best suited to the needs of the particular case. The greatest compliment I have ever had came from a client who told me he did not see how I could go into such detail and make anything out of the work. I would rather have this said and know that the resulting plans and specifications gave the contractor an opportunity to do good work and a chance to make a reasonable profit than make money on the job by slighting my end of it.

The engineering profession is not free from blame in these matters as in order to get work, offers to furnish plans and specifications are often made at ridiculously low figures, much less than the actual cost for draftsmen and office expense of the man who does good work will amount to. As an example I recently quoted a client a flat sum of \$600 for preparing a set of plans and specifications. After I had received the commission, he told me that an apparently responsible party had offered to do the work for \$110. The result—I am sure, had this work been turned out for such a low figure, could not by any stretch of imagination have been called a first class piece of engineering.

Now let us get together and help one another. We can do it by co-operation. The engineer can give you first class tools to work with, so that you will know what to do and then the most important of all is for you to do it. Give him advice when he needs it so that he can prepare his work in such a way as will enable you to do yours in the most efficient manner and with profit to yourselves.

The owner and architect, by trusting to the engineer, will secure an economical and efficient installation. Let the jobber and the manufacturer bring to the engineer's attention their various products, he will discuss with the owner their cost and the reasons why they should be used and in this way the owner can make his decision on an economic basis. Have the engineer make the estimates that go to make up the original budget for the building and then the electrical equipment will not be handicapped by lack of funds and you will then have a fighting chance for a living profit.

All of this you can greatly help the engineering profession in bringing about if you will urge the owners and architects to handle their work the way it should be done, and that is through the engineers.

BUSINESS IN THE PACIFIC NORTHWEST.

(The following items are abstracted with particular reference to the electrical industry from R. G. Dun & Co.'s semi-annual trade review for Oregon, Washington and Idaho.—The Editor.)

The general depression which has existed throughout the United States and Canada is apparent in the Pacific Northwest.

Two potent factors have been introduced into the business world in a degree not yet fully realized. The first is a new humanitarianism which demands the entire abolition of privilege. The new charter of business is to be founded on the axiom that equal fidelity in discharge of duties shall receive equal reward. To this can be referred such movements as income tax, minimum wage and old age pensions. The second is governmental direction of capital which can no longer be left to individual initiative with assurance of safety. Rate and trust regulation and the Federal Reserve Bank are referable to the latter.

Similar revolutions have marked the past. The world-wide readjustment of methods to conditions is considered practically complete and resumption of confidence and activity is seriously expected. The anomaly of bountiful prosperity in products of the forest, field, mine and sea and commercial stagnation should not much longer continue.

The total of railroad and street railway expenditures for construction and betterment has fallen to a low amount. The difficulty of securing capital for large undertakings is the chief deterrent. A number of logging roads are being constructed and some terminal improvements are being built, but few projects of large proportion are under way.

At Portland two houses report general decrease in volume of sales. Cost of doing business has decreased 5 per cent; failure losses increased 10 per cent, and net profits slightly less. General timidity is assigned as the cause of decrease and the outlook is for slightly better trade.

At Spokane one concern shows an increase in city sales of 30 per cent and a decrease in the country of 10 per cent, done at a decrease of .03 per cent. Net profits 5 per cent greater. Losses through failures 40 per cent greater. Need construction work. Collections somewhat close, but accounts mostly good. Another shows a decrease in aggregate sales of 10 per cent, done at an increased expense of 11 per cent. Losses through failures 3 per cent less. Net profits 34 per cent less.

At Tacoma electrical houses complain of poor conditions largely attributable to suspension of building operations. Prices, however, are better and net profits have increased about 10 per cent over the same period of last year. Collections are fair and with a considerable amount of work already in sight, prospects are good.

No specific report on the electrical supply business is given for Seattle, though in view of the excellent crop prospects, it is the general opinion that improvement in trade conditions will be noted during the latter part of the year.

EFFICIENT POWER PLANT MANAGEMENT

CORRESPONDENCE FILING CLASSIFICATIONS.

(Continued.)

100—Land and Structures.

110—Real Estate—Right of Way—Franchises—Leases.

- 111—For Buildings or Special Structures.
- 113—For Electric Transmission Lines.
- 114—For Gas Plant Uses.
- 115—For Water Distributing Systems—Dams—Reservoirs—Canals—Pipe Lines.
- 116—For Highways and Railways.
- 117—Franchises and Franchise Valuations.

120—Buildings.

(For Structural Materials, see 710.)

- 121—Proposed Extensions.
 - 121.1—Cost Analysis & Unit Costs.
 - 121.2—Valuations—Preliminary Reports.
 - 121.3—Investigations.
 - 121.4—Location.
 - 121.5—Program of Work.
- 122—Design and Construction Details—Specifications—Contracts—Bids.
- 127—Maintenance.
 - 127.1—Cleaning and Sanitation of Buildings and Yards.

130—Special Structures—Fences—Storage Bins.

- 131—Proposed Extensions.
 - 131.1—Cost Analysis and Unit Costs.
 - 131.2—Valuations—Preliminary Reports.
 - 131.3—Investigations.
 - 131.4—Location.
 - 131.5—Program of Work.
- 132—Design and Construction Details—Specifications—Contracts—Bids.
- 137—Maintenance.

200—Rates—Statistics—Contracts—Advertising.

202—Contracts.

- 202.3—Electric Contracts.
- 202.3—Electric Contracts.
- 202.32—Industrial Power and Lighting Contracts.
- 202.33—Street Lighting Contracts.
- 202.4—Gas Contracts.
- 202.5—Water Contracts.
- 202.9—Other Contracts.

(Note:—File specifically when possible.)

210—Statistics.

- 213—Electrical Statistics.
 - 213.1—Irrigation Power statistics.
 - 213.2—Industrial Power and Lighting Statistics.
- 214—Gas Statistics.
- 215—Water Statistics.
- 216—Railway Statistics.
- 217—Mdse. Sales Statistics.

230—Campaigns—Soliciting—Advertising.

- 230.1—Co-operative Campaigns — Bonuses — Profit Sharing.
- 230.11—Electric Campaigns.
- 230.12—Gas Campaigns.
- 230.2—Printed Advertising.
- 230.3—Fairs and Expositions.
- 230.4—Window Displays.
- 230.5—Demonstrations.

250—Rates and Tariffs.

- 250.1—Tariffs of Pacific Power & Light Company.
 - 250.13—Electric Tariffs.
 - 250.14—Gas Tariffs.
 - 250.15—Water Tariffs.
 - 250.16—Railway Tariffs.
- 250.2—Tariffs and Rates of Other Companies. (Correspondence File.)

253—Electric Rates.

- 253.01—Tariffs and Rates of Other Companies. (Documental File.)
- 253.1—Domestic Lighting.
- 253.2—Commercial Lighting.
- 253.3—Advertising Lighting.
- 253.4—Power (Industrial where not Specified.)
- 253.5—Irrigation Power.
- 253.6—Flour Mill Power.
- 253.7—Cooking Power.
- 253.8—Municipal and Street Lighting.

254—Gas Rates.

- 254.01—Tariffs and Rates of Other Companies. (Documental File.)
- 254.1—Lighting.
- 254.2—Cooking.
- 254.3—Heating.
- 254.4—Municipal and Street Lighting.

255—Water Rates.

- 255.01—Tariffs and Rates of Other Companies (Documental File.)
- 255.1—Domestic.
- 255.2—Industrial.
- 255.3—Municipal.

256—Railway Rates and Tariffs.

- 256.1—Freight.
- 256.2—Passenger.
- 256.3—Express.

Note:—In the case of a hydroelectric development, the matter as a whole shall be considered as hydraulic works, but correspondence relating to specific things shall be filed independently of the above ruling. Thus, letters relating to a hydraulic feature of the development shall be filed under the 500 series; letters relating to a feature of the power house structure shall be filed under the 120 series; and letters relating to electric details of the development shall be filed under the 300 series.

[To be continued.]

Sterilization of water by ultra-violet rays from a mercury-vapor quartz lamp is a promising source of income for central stations. The water must first be filtered and then exposed to the influence of the rays, baffle-plates being frequently employed to keep the water sufficiently agitated. One form of apparatus for home use sterilizes 20 gallons per hour with an energy consumption of 250 watt-hours.

The doctrine of principal and agent (as the proper relation existing between the public and the public utility company) fails at the point of fixing responsibility for the supplying of initiative. Ordinarily the principal conceives and the agent executes.

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POWER AND GAS

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An astounding discovery has been made by a wise man from the East—since all the coal must be consumed some time and since water power can be used just as well when the coal is exhausted as now therefore, the present use of water power can effect no eventual saving in fuel; it “simply renders available, at some future period, a certain proportion of the fuel which might otherwise have been consumed at a prior date.”

Like the socialist who expects to carry out one of the two great ideals of the Bible, the service of all men by all other men, by opposing it to the other great ideal, the value of the individual, so this enlightened engineer would accomplish one ideal of true conservation, the prevention of waste of those resources which cannot be renewed, by fighting the other ideal, the wise utilization of those fleeting resources which are regularly renewed.

The conservation which has resulted from the more efficient use of fuel “far exceeds any results that could have been attained by the use of all the water powers in present service.” The non-utilization of water power “is no more of a loss to the world than our present lack of use of the heat of the sun, the movement of the wind, or the rise and fall of the tides.”

Such sophistry would be beneath notice if it were not for the fact that these ravings carry a certain prestige as part of a paper presented before the American Society of Heating and Ventilating Engineers. Were we not acquainted with the noble purposes of that organization and its constituent members this futile effort to stem the tide of progress might be considered as the swan song of a dying profession, the last gasp of a drowning man. Heartily agreeing that the effective utilization of the fuels which nature has so abundantly placed at our command constitutes true conservation, is not sane reason for this distorted antagonism to the development of water power.

The expenditure of the public's money “on the vacillating waters of falls, rivers and rapids, where coal stands ready at less cost to afford cheaper and better service” is not within the power or the purpose of the most radical conservationist, nor has “conservation widened into the advocacy of the development of water powers as a substitute for the use of fuel.” Such a policy would be even narrower than the perverted view of this heating and ventilating engineer fearful that his brother engineers will lose their jobs. Open the window and let in some fresh air.

While we of the West are pointing out the ion in our Eastern neighbors' views, we must not overlook the dangers from the macrocosm in our own.

Federal versus State Control

From time to time this journal has called attention to the hardships that are now being imposed upon those men who are endeavoring to promote the general good by developing the latent natural resources of the West, whether of timber, mineral or water power. The injustice has been shown of compelling the power locator to serve the will of two masters, the state and the nation, each imposing a discriminatory tax on water power de-

velopment, the state on the right to use the water, the nation on the right to occupy the land drained by that water. It has been frequently demonstrated that this dual tax is heavier than would be the rental of similar private holdings, the federal tax especially, being based not on the intrinsic value of the land, but on the value of the water flowing over it.

But no matter how true these facts nor how heavy the burden entailed, they should not be made the excuse for reactionary suggestions of rebellion against sovereign authority. There are state rights, but there are also national rights.

In accordance with the requirements of that beneficent mechanism known as government, the individual cheerfully surrenders certain personal rights to the city or county so as to gain compensating community benefits. The city or county, in turn, voluntarily delegates certain of its functions, such as rate-making, to the state. The state, likewise, entrusts certain powers, such as the control over the public domain, to the nation, just as nations also agree to submit specified matters to a tribunal of other nations.

Once these rights have been surrendered they can seldom be resumed without a revolution of the entire social framework. The rights established by custom frequently contravene the rights established by law. They can be overthrown only by war.

The specific application of these generalities is found in this question of federal versus state control of water power development. There are those who believe that the presumption of the federal government is fundamentally wrong in considering that its trusteeship invests it with the same powers as would absolute, permanent ownership, and that the mask of conservation is being used to further plans for the establishment of a long distance administrative bureaucracy. Likewise there is an effective public opinion that the rights of the many can be more adequately protected by this means, even if it is done at the expense of the few.

As a matter of fact there should be no conflict between these divergent views. Mutual concession should admit of mutual understanding on a common ground. With respect to the prevention of destructive waste there is little difference between the interest of the individual and the interest of the public. As to the waste due to misuse the interest of the individual must be subordinated to the interest of the public just as in the case of the waste due to non-use it would be well to even give a slight advantage to encourage the individual developer.

Instead of arraying these interests against each other they should be harmonized so that they will co-operate to co-ordinate a mutually satisfactory water policy.

The advantages of a strongly centralized government are too great to be lightly cast aside at slight provocation. In the ultimate analysis state authority and federal control will be found to revolve in concentric orbits with the will of the people as the driving force which creates each. And finally patriotism, above all else, will see to it that the American people carry out the policy of conservation to which they are definitely pledged.

The present estimated stand of three thousand billion feet of lumber is being depleted at the rapid rate of sixty billion feet or more annually. An investigation is to be made by the Forest Service, the Bureau of Foreign and Domestic

The Economy of Effectiveness

Commerce, the Bureau of Corporations and the Bureau of Standards, each co-operating in their respective fields—to the end of determining the most advantageous methods of using, without waste, the present stand of timber, and the possibility of applying forestry to the future management of timber lands.

At present, both forestry and milling are so wasteful that it is estimated that from one-third to one-half or more the tree timber is burned as worthless, either in the slash fires or waste burners. It is also claimed that it is practically impossible to market the poorer grades of lumber in the home market. Outlets for these are, therefore, to be found abroad.

All this brings vividly to mind the deplorable mill fires which have recently been reported with monotonous regularity. As millions of feet of milled lumber are destroyed in this way, it would appear that those who design mills might well further this new conservation, as it almost invariably occurs that the fires have their origin in the boiler room, the drying kilns, or, near the waste burner.

Mill designers should recommend, and if found necessary, actually enforce, precautionary measures which adopted by the industry would practically eliminate these disastrous fires.

The boiler room is almost invariably in the heart of the mill, the waste burner quite convenient, and the drying kiln equally so. These should certainly be isolated, and could be at but slightly additional expense.

The principal hazard consists in the burning of mill refuse, and various shifts have been tried to avoid having to do this. Herein lies opportunity. It has been used for steam generating purposes with a considerable measure of success. It has been used with experimental success for the generation of illuminating gas and in this direction the possibilities are vast. It has been successfully briquetted, for domestic fuel purposes. In British Columbia the waste from soft woods, by a process of pulverizing, shredding and drying, has been brought into a condition which permits its being compressed into briquettes either with or without the addition of other combustible by-products such as tar, pitch, and so forth. Hardwood may be more readily handled in this way.

Only those who have witnessed the mill refuse fires, mountain high, burning fiercely year in and year out, can marvel most that genius has not devised many methods of preventing this sinful waste. Effective utilization only is economy and it is to be hoped that the investigation to be now carried on will discover ways and means of effectively utilizing mill and forest waste. In the meantime, it must be recognized that the opportunity belongs to the qualified engineer, the man who does not cling too closely to custom but whose designs are based upon the economy of effectiveness.

PERSONALS

A. J. Bowie, electrical and mechanical engineer at San Francisco, is expected to return from San Diego this week.

I. N. McKinney of NePage, McKinney Company, electrical contractors, Seattle, arrived in San Francisco during the week.

N. D. Powell, contractor of Stockton, Cal., and Mrs. Powell, were visitors to San Francisco during the week on a business trip.

J. Van Huysen, salesman of the General Electric Company, Fresno, Cal., was an arrival in San Francisco during the week.

J. Carter, district manager of the San Joaquin Light & Power Company at Taft, California, spent the week in San Francisco.

W. Brewster Hall, Pacific Coast representative for Pass & Seymour Company, has returned to San Francisco from an Eastern trip.

C. A. Gray, district superintendent of the Pacific States Telephone Company at Pullman, was at Spokane, Wash., during the past week.

Don C. Ray, manager Contra Costa District, Pacific Gas & Electric Company, located at Martinez, was a recent visitor in San Francisco.

Chas. Brown, traveling auditor for Westinghouse Electric & Manufacturing Company, East Pittsburg, spent the last week in San Francisco.

E. R. Davis, general manager of the Pacific Light & Power Company, Los Angeles, spent a few days during the past week at San Francisco.

E. J. Crawford, superintendent of distribution, San Joaquin Light & Power Company, Fresno, was a visitor to San Francisco during the week.

A. E. Wishon, assistant general manager, San Joaquin Light & Power Company, Fresno, spent several days in San Francisco during the week.

W. A. Blair, treasurer Pacific States Electric Company, San Francisco, returned during the week after a several days' trip to Southern California.

S. B. Anderson, district manager Pacific States Electric Company, San Francisco, left during the week for a trip through the Tahoe region.

A. H. Babcock, consulting electrical engineer for the Southern Pacific Company, is making an automobile trip through California and Nevada.

P. H. Affolter, salesman with Fairbanks, Morse & Company, San Francisco, recently returned from an extended trip through the San Joaquin Valley.

Geo. R. Murphy, treasurer for Pierson, Roeding & Company, and Pacific Coast representative of the Electric Storage Battery Company, is at Philadelphia.

C. A. Johnson, representative of the C. A. Wood Preserver Company at San Francisco, returned during the week after an extended trip through the northwest.

E. M. Cutting, manager Edison Storage Battery Supply Company, San Francisco, returned the first of the week from an extended trip through the Pacific Northwest.

Fred L. Webster, Pacific Coast manager of Allis-Chalmers Company, San Francisco, returned during the week from a trip to Los Angeles and the southern part of the State.

F. C. Carman, representing the National Electric Heating Company of Toronto, Ont., is making western Canadian cities and arrived on the Pacific Coast during the past week.

W. T. Wallace, general manager of the Great Shoshone & Twin Falls Water Power Company, is in Salt Lake City in connection with extension of his company's business.

O. P. McCord of the Westinghouse Electric & Manufacturing Company's sales force, San Francisco, is confined to his bed, having recently undergone an operation for appendicitis.

Miss Nell Howard Murray, daughter of Fred Murray, and in charge of the Los Angeles office of the National Carbon Company, visited San Francisco during the week on a business trip.

S. M. Frew, assistant manager light and power department, British Columbia Electric Railway Company, was at Seattle, Wash., during the past week on a combined business and vacation trip.

C. J. Wilson, assistant engineer of electrical distribution for the Pacific Gas & Electric Company, has been elected chairman of the San Francisco Section of the American Institute of Electrical Engineers.

H. P. Wilson, secretary of the Great Western Power Company, and **Edward Beardsley**, chief engineer, inspected the Oakland district during the past week under the guidance of **Frank H. Woodward**, manager of the Oakland division.

Bion J. Arnold, street railway traffic expert, and well known on the Pacific Coast, is at present detained in Germany, where he was visiting at the time of the outbreak of hostilities, with a number of traffic men investigating practice in European countries.

J. G. M. Connally, until recently with the Western Canada Power Company, has now engaged in business as an electrical engineer, undertaking electric lighting and power contracts, dynamo and motor repairs, steam, gas and oil engineering, at Vancouver, B. C.

James Morris, of Portland, Ore., was appointed at the last council meeting of the city of Lewiston, Idaho, to make a preliminary estimate of the cost, amount of power available and other data relative to the proposed dam and power site on the Clearwater River to be developed by the city.

H. W. Dyson has been appointed comptroller of the British Columbia Electric Railway Company at Vancouver, B. C., succeeding **Geo. Kidd**, who has been promoted to the position of general manager. Mr. Dyson was assistant comptroller of the company from 1910 up to the time of his promotion.

Richard H. Dearborn, professor of electrical engineering at the University of Oregon at Eugene; **C. S. Hull**, foreman of the standardizing laboratory of the General Electric Company at San Francisco, and **S. C. Lindsay**, electrical engineer for the Seattle Electric Company, at Seattle, have been transferred to the grade of member in the American Institute of Electrical Engineers.

MEETING NOTICES.

Nevada First Aid and Mine Rescue Field Meet.

On September 7th a first aid and mine rescue field meet will be held at Reno under the auspices of the Engineering School of the University of Nevada, **J. G. Scrugham**, dean. Fifteen teams of five members each have been entered, representing all the large industries of the state. The State Electrical Association will hold its quarterly meeting on the same day. Among the papers to be presented will be one on the Buckhorn Locomobile Plant Performance by **J. G. Scrugham** and **A. N. Voss** and Nitrogen Headlight Performances by **A. G. Jones**.

San Francisco N. E. L. A. Convention Committee.

John A. Britton, chairman of the General Convention Committee for the San Francisco meeting of the National Electric Light Association in 1915, called a meeting of the local committee on August 17th when plans were made for active work by the various sub-committees. It was decided

that such general meetings will be held every other week from August 31st in order that the several sub-committees may submit their plans for general discussion. It is particularly desired that wide publicity be given to the fact that the Exposition will be open on schedule time and that rumors of war will not interfere with the success of the N. E. L. A. convention.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Pacific Power Company of Mono county has filed an application asking the commission to validate 100 promissory notes totaling \$100,000 issued without the consent of the commission.

The commission has rendered a supplemental decision authorizing the Southwestern Home Telephone Company of Redlands to issue promissory notes in the sum of \$4500 and to pledge bonds therefor in the ratio of 2 to 1.

The Consolidated Securities Company has filed an application with the Railroad Commission asking authority to sell the telephone system in the City of San Fernando, Los Angeles County, to the San Fernando Telephone and Telegraph Company.

The Railroad Commission has rendered a decision dismissing the application of the Midland Counties Public Service Corporation for authority to issue a note in the sum of \$6500. The application was dismissed on the request of the corporation.

The commission has rendered a decision authorizing the Roseville Telephone Company to issue 100 shares of capital stock of the par value of \$10 per share. The proceeds from the sale of this stock are to be used for additions and betterments to the company's plant.

The commission has rendered a decision authorizing the Soledad Land & Water Company to sell certain portions of its property. The Soledad Land & Water Company is endeavoring to change its status from a public utility corporation to a mutual water company.

The Butte Valley Telephone Company, operating in the vicinity of Dorris, Siskiyou County, has filed an application with the Railroad Commission asking authority to issue 22 shares of stock in lieu of other shares previously issued without the consent of the Commission.

The Railroad Commission has rendered a decision authorizing the Hanford Gas and Power Company to issue a promissory note in the sum of \$6000 for 90 days at 6 per cent with authority to reissue in the same or smaller amount up to and including August 10, 1915.

The Postal Telegraph-Cable Company has filed a complaint with the Railroad Commission against the Western Union Telegraph Company. This complaint is the outgrowth of a suit relative to the transfer of telegrams brought by the Postal Company against the Western Union before the Public Service Commission of New York.

The Northern California Power Company, Consolidated, has filed an application with the Railroad Commission asking authority to issue \$500,000 par value of preferred stock at \$80 per share. This is a 6 per cent cumulative stock and it is proposed to use the proceeds thereof to reimburse the company for moneys actually expended from income.

The Railroad Commission has issued a supplemental order authorizing the Southern California Edison Company to issue 321 of its 5 per cent bonds, having a par value of \$1000 each, at 87½ per cent and accrued interest. These bonds are the last remaining portion of an issue of \$2,500,000 authorized by the Commission in the latter part of January, 1913.

The commission has rendered a decision authorizing the Oakland, Antioch & Eastern Railway, operating between Oakland and Sacramento, to issue \$900,000 of 3-year promissory notes bearing interest at the rate of 6 per cent per annum.

These notes are to be redeemable at the option of the railroad at any interest date at their face value and accrued interest on not less than 30 days' notice. The company is further authorized to issue \$330,000 face value of first mortgage 5 per cent bonds and pledged these bonds together with others heretofore authorized by the commission as security for the payment of the notes at the ratio of 2 to 1. These notes will be convertible, at the holder's option before maturity on the basis of 80 per cent of the par value of the bonds with accrued interest as against the par value of the notes with accrued interest. The commission's order provides that the notes shall be sold for not less than 96, provided, however, that the company may pay a commission for their sale of not to exceed 4 per cent.

California Commission Order on Inductive Interference.

The California Railroad Commission has issued a general order to the power companies of the state regarding inductive interference. This order is based upon the exhaustive investigation of a committee which will present its formal report at the Spokane meeting of the American Institute of Electrical Engineers, at whose specific request the details will not be published until after the meeting. The order differs from the recommendation of the committee in being retroactive, affecting past as well as future construction. It provides for avoidance of parallelism between power and communication lines when possible and for care in making transpositions. In any power circuit involved in a parallelism no grounded single-phase or grounded open-star transformer connections shall be employed, the use of air switches is practically prohibited and deviations from a pure sine wave shall not be allowed to exceed the limit imposed by the A. I. E. E. Standardization Rules.

NEWS OF IDAHO PUBLIC UTILITIES COMMISSION.

The public utilities commission will probably issue, within the next few days, an order which will standardize the operation of crossings of power lines, interurban systems and signal wires, which will conform to the ideas of the officials of power, traction and railroad companies, whose representatives have been in conference in Boise, since Monday morning. The meeting of the representatives of the various corporations was called at the request of the public utilities commission who desired, before taking action, to have those affected outline an order or rule, which would insure the safety of the public.

The sessions at the Owyhee hotel were presided over by Chas. E. Cochran, assistant general attorney of the Oregon-Washington Railroad & Navigation Company, Portland, Ore. Fred L. Goddard of the Utah Power and Light Company, acted as secretary.

The greater part of Monday and Tuesday sessions was devoted to receiving statements from the representatives of the various organizations. All were unanimous in their suggestions for the safety of the public and all possible friction was settled satisfactory to all. The agreement will probably be signed and sent to the public utilities commission today.

BOOKS RECEIVED.

Arizona Corporation Commission. First Annual Report; 1055 pp.; 6x9; published by the Board of Control, Phoenix, Ariz.

According to the constitution of Arizona control of public utility corporations, as well as all other corporations, is vested in a three-member commission whose report for the period from February 14, 1912 to December 1, 1913, is here presented. In addition to a summary of the corporation laws of the state and definitions of the commission's powers and duties it contains copies of all special orders issued, all complaints investigated and all docket cases handled by the commission. Details are given of the uniform system of accounts prescribed by the commission and many other matters of interest have been compiled here.

OREGON UNDERWRITERS' BUREAU ON GROUNDING SECONDARIES.

Electrical Circular No. 49.

The general regulations governing overhead and underground construction of telegraph, telephone, signal, trolley and power lines within the State of Oregon became effective October 1, 1913; and Rule 14 of these regulations requires the grounding of the neutral point or wires of all transformer secondaries. This order does not affect municipally owned electric utilities and only applies to new construction work of privately owned electric utilities.

The National Electrical Code Edition, 1913, Rule 15 (b) requires grounding of all installations, old and new, regardless of ownership.

Rule 15 (b) of the National Electrical Code reads as follows:

b. Transformer secondaries of distributing systems (except where supplied from private industrial power or lighting plants where the primary voltage does not exceed 550 volts) must be grounded, provided the maximum difference of potential between the grounded point and any other point in the circuit does not exceed 150 volts and may be grounded when the maximum difference of potential between the grounded point and any other point in the circuit exceeds 150 volts. In either case the following rules are to be complied with:

1. The grounding must be made at the neutral point or wire, whenever a neutral point or wire is accessible.

2. When no neutral point is accessible, one side of the secondary circuit must be grounded.

3. The ground connection must be at the transformers or on the individual service as provided in sections c to g, and when transformers feed systems, with the neutral wire, the neutral wire must also be grounded at least every 500 feet.

This bureau also feels that thorough grounding of all alternating secondary systems affords the best protection to life and property.

Central Station will kindly answer the following questions in writing, concerning the system of distribution:

1. Do you ground your secondary transformers at the neutral points, or neutral wire, in both old and new work?

2. Do you ground your secondary transformers at neutral points or wires in new work only?

3. Do you ground one side of secondary circuit in lieu of the neutral points or wires, in old and new work?

4. Do you ground one side of secondary circuit in lieu of the neutral points or wires, in new work only?

5. Kindly state reasons why you do not ground your transformers, at the neutral points or wires.

6. If your system is grounded, describe method used to ground same.

7. If you have not grounded your old and new construction, do you intend to do so and by what date will this be accomplished?

8. If you have not grounded your old construction, do you intend to do so and by what date will this be accomplished?

Note:—If your company operates in more than one town or city, kindly segregate the information on each if necessary.

Electrical Circular No. 50—Porcelain.

After November 1, 1914, this Bureau will require all porcelain such as tubes and bushings, cleats and knobs to conform at least to all the requirements of the National Electrical Code.

Tubes and Bushings—Rule 61.

Cleats—Rule 62.

Knobs—Rule 64.

Recently our attention has been called to several stocks of solid No. 5½ porcelain knobs, which do not comply with the above rules in the following respects:

- (1) Less than 1½ in. in diameter;
- (2) Depth of wire groove;
- (3) Un-uniform as regards height;
- (4) Glazing of poor quality in some cases;
- (5) Easily broken.

Therefore, in future, kindly insist when purchasing porcelain, that it complies with the general requirements of the National Electrical Code, Edition 1913, as the manufacturers are in a position to furnish same if you insist upon it.

UNDERWRITERS' EQUITABLE RATING BUREAU,

F. D. Weber, Electrical Inspector.

PACIFIC GAS & ELECTRIC TENNIS TOURNAMENT.

The fourth annual tennis tournament of the Pacific Gas & Electric Company, San Francisco, will be played in Oakland, Sunday, August 23rd. Owing to the great form shown in practice games it is predicted that S. J. Lisberger and A. L. Trowbridge, will play the finals, although E. B. Henley promises to figure as a contender for the cup, which is annually at stake.

TRADE NOTES.

Woodill & Hulse Electric Company has been given the contract to furnish the city of Los Angeles with 977 traffic signs.

Drennen Electric Company has the electrical contract for the apartment house being erected by A. Shogren at Seventh and Madison streets.

H. A. Bullard has opened an office as special designer for special electric and hydraulic apparatus in the Underwood Building, San Francisco.

The contract for installing a freight elevator at the B. C. Electric car barns has been awarded to P. E. Harris & Company Crown Building, Vancouver B. C.

The Sierra and San Francisco Power Company has closed with Westinghouse Electrical and Manufacturing Company for a period of years on their contract for service transformers.

The Capital Electric Company of Salt Lake City has recently closed a contract with the Newhouse Hotel Company for the installation of a 7½ h.p., 3 sweeper Spencer turbine cleaner plant for the Newhouse Hotel now nearing completion.

The W. H. Smith Electric Company of Portland, Oregon, has obtained the following electrical contracts: Feldenheimer Building on the northeast corner of Fourth and Salmon. The Halman Building on Third and Mill streets, and the new Signal Tower, N. P. R. Co.

The plant and stock of the Fern Ridge Lumber Company at Fern Ridge, B. C., on the Fraser Valley Branch of the B. C. Electric was completely destroyed by fire last week. The loss is estimated at \$150,000, with \$100,000 insurance; \$72,000 on the mill, and \$30,000 on the stock in the yards. There were several million feet of lumber in the yards. Fire started in the dry kiln. No announcement has been made as to whether the mill will be rebuilt.

SEATTLE WOULD LICENSE ELECTRICAL CONTRACTORS.

At a meeting of the council of the city of Seattle, Wash., held last week, Councilman Cooley introduced an ordinance requiring that all electricians take out a license with the city and put up a bond of \$1000. Persons under 21 years of age are forbidden to supervise or install electrical work. Certain exceptions are made to cover apprentices. The same bill allows for certain changes in the current carrying capacity allowable for wires under special conditions.



INDUSTRIAL



MODERN FIXTURE FACTORY AT PORTLAND.

BY F. D. WEBER

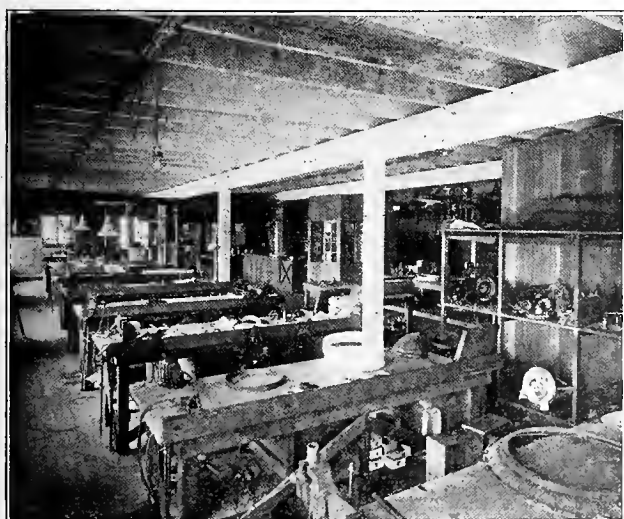
No student of commercial conditions who is keenly interested in his subject cannot help but be impressed with the rapid specializing process which is abroad in all lines of endeavor. In no business is this more marked than in the electrical line. All of us can remember for instance when lighting fixtures were displayed only over bath tubs and wash-



Factory Exterior.

stands in the local plumber's shop and the designs shown were the cheapest that the designer could imagine. What a long step in a forward direction is the modern lighting fixture display room? An examination of these two extremes accentuates the fact of a decided change in the attitude of the public mind on this particular subject i.e. "they are no longer ugly necessities, but rather a vital component part of the interior decorative scheme."

During the recent convention of the Oregon Electrical Contractors' Association held in Portland the program committee included in its attractions a visit to the new factory and show rooms of the J. C. English Company, 165 Union Av-



Lighting Fixture Factory.

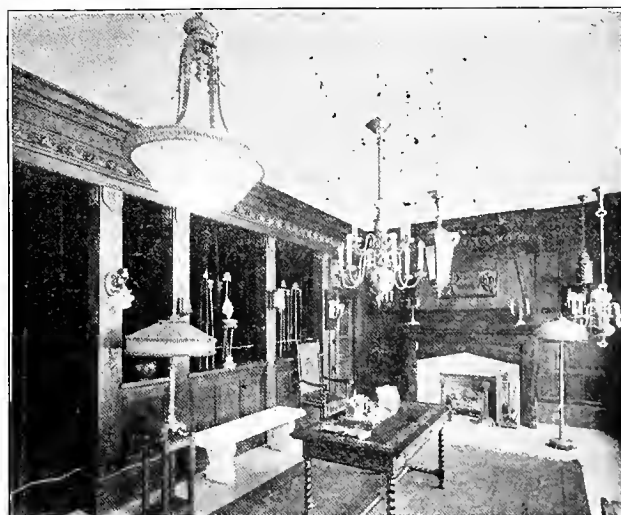
enue North, corner Irving, and it must have been gratifying to the company to hear the expressions of surprise and commendation heard on all sides.

Aside from the completeness of the manufacturing facilities and the beauty of the show rooms the fact that this business had moved its display rooms from the center of the con-

gested district to the East Side so as to be combined with its factory in order to promote efficiency seemed to all a daring move. Some of us felt English must have read what Elbert Hubbard said in the Philistine: "If you write a better book or build a better mouse trap, though your shop be in the woods a beaten path will be made to your door."

The object of this article is to demonstrate what can be done in a simple way to properly equip a lighting fixture plant with the objects of promoting efficiency and to maintain dignity, all at a modest cost.

The building is two story, 50x100 ft. It is situated on a corner so as always to preserve the light. The first floor is used almost exclusively as a show room. Entering from Union avenue between two large bay trees flanked on both sides by beautiful flowers, you are ushered into the reception room paneled to the ceiling with fir wainscoting finished to resemble English oak. The style of the room is early English and the heavy woodwork is relieved by warm red velvet hangings. The floor is covered with Oriental rugs neutral design giv-



Show Room.

ing the room a cosy homelike atmosphere and this is added to by a beautiful tile mantle especially designed for the place.

The general office of the company is in the opposite corner so as to give immediate attention to visitors and back of this is the office of the manager.

Passing through the reception room you enter an L shaped room where most of their simpler fixtures are displayed. The reason for this being next to the reception room is to eliminate the necessity of taking everyone into the more elaborate rooms still further in the rear.

The most beautiful show room the writer has ever seen is the Colonial room, which is 24x32 ft. The woodwork is ivory and the walls a grey glass cloth. This is relieved by a handsome colonial mantle with green tile. The hangings are also in green.

Special offices are occupied by the designing staff. A room is provided for displaying fixtures particularly adaptable for bungalows and suitable space is also provided wherein fixtures on a particular job can be shown together, doing away with the necessity of passing back and forth, thus concentrating the customer's attention on the pieces they are interested in.

The rear of the first floor is occupied by the gilding and finishing department as well as a large shipping room; an elevator at this point delivers the freight to the manufacturing department on the floor above.

The entire second floor is a delight to the workman who appreciates sanitary conditions. The greater portion of the wall space is occupied by windows, the whole interior is painted white and they have just installed a ventilating system to change the air in the factory oftener.

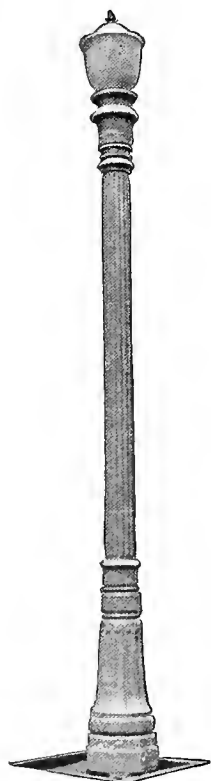
The factory is equipped with all modern machinery, electrically driven, and the heating is done by the Rector gas system. Each workman's bench is supplied with gas, air and electricity. A separate stairs leads to the garage on the first floor, this allowing them to load without going outside.

The company has been in business five years and has lighted most of the principal buildings in Portland and has done a great deal of work throughout the Northwest. They have recently finished the Northwestern Bank Building, Pittock Block, Pittock residence, Supreme Court and Library Building, at Salem, Multnomah County Court House and every bank built in Portland since they have been in business except one.

NEW UNITS FOR ORNAMENTAL STREET LIGHTING.

An attractive line of fixtures, designed for operation of the new sizes of Mazda series lamps for "White Way" or ornamental street lighting, is now being made by the General Electric Company. These new fixtures are termed Novalux ornamental units, are made for both series and multiple operation and will accommodate the 400 and 600 c.p. 6.6 amp. and the 600 and 1000 c.p. 20 amp. sizes of the series Mazda, and the 400, 500, 750 and 1000 watt multiple Mazda lamps.

They are made in two general styles, the only difference however, being in the glassware equipment. The glassware or, one style, Form 4, consists of a medium alabaster globe, which is so shaped that it is completely filled with light



Novalux Ornamental Street Lighting Unit.

and permits a certain amount of light to pass upward and illuminate the building fronts. There is a small reflector placed at the top and inside of the globe. The function of this reflector is to direct downward and make useful the light that would otherwise be lost in the bottom of the ventilator surmounting the globe.

The other style of unit, Form 5, has a two-piece globe. The bottom part is made of C. R. L., that is, crystal rough inside glass, while the top is made of Pyro glass. No reflector is used, as the Pyro top is made of dense glass hav-

ing the inside glazed, thereby reflecting downward some of the light, although enough filters through to illuminate properly the building fronts.

These new units are highly ornamental and the casings, which are designed to form the capital of the pole, are made in four different styles, from which a selection can be made to harmonize with the pole design.

As ventilation is an important feature in fixtures designed for the new sizes of Mazda lamps, this matter has been given careful attention. Air enters through small holes in the globe seat and leaves, in the case of the Form 4 unit, through concealed openings in the spun copper ventilator at the top of the globe; and, in the case of the Form 5, it leaves through the space provided between the top and bottom globe. The socket used in these fixtures is made in skeleton form which permits a circulation of air to all parts.

As the efficiency of the 20 amp. Mazda series lamps is much higher than that of the 6.6 amp. lamps, the Novalux ornamental series unit contains an internal individual compensator mounted inside of the ornamental casing.

These compensators operate the 20 amp. lamps on 6.6 or 7.5 ampere circuits. This saves about 30 per cent of the energy required to operate the lamps and permits them to be connected in standard existing circuits, thereby allowing the extension of the lighting system without additional station equipment.

The compensator also reduces the effect of destructive current surges that may be set up by arcing or permanent grounds. Two different sizes of compensators are made for use respectively with the 600 and 1000 c.p. 20 amp. series Mazda lamps and are equipped with taps for operation on either 6.6 or 7.5 ampere series alternating constant current circuits. The series unit is mounted on a strain insulator whose function is to keep high voltage from the poles.

The multiple Novalux ornamental units are similar to the series except that the strain insulator is replaced by a cast iron adapter of similar dimensions and no compensators are used.

A NEW CADDY CALL.

A novel installation of the chau-phone, the Western Electric Company's limousine telephone, was made recently at the Los Angeles Country Club, Beverly Hills, California. It has been the custom of that club's golf professional to call his caddies by megahone when he wanted them to go out with the players.

A Western Electric chau-phone was installed. Now caddies can be summoned at once, the professional saves his lungs, club members are paged, the progress of matches announced, and many other practical uses made of the device.

EXAMINATION FOR JUNIOR ENGINEER.

The United States Civil Service Commission announces an open competitive examination for junior engineer (experimental plant and machine testing), for men only, on September 2 and 3, 1914, at a salary ranging from \$1200 to \$1800 a year. The duties of this position will consist of designing, constructing, and operating plants for experimental and demonstration purposes in the preparation of certain fruit and vegetable products, especially fruit and vegetable drying and refrigeration, the computing and compiling of technical and cost data on the operation of such plants; and a limited amount of mechanical drafting.

Competitors will be examined in mechanical and dynamics of engineering, technical engineering testing, education and experience.

Applicants for this position must have a mechanical or electrical engineering degree from a technical school of recognized standing, and two years' practical experience, subsequent to graduation in an experimental laboratory or in machine testing.



NEWS NOTES



INCORPORATIONS.

SALT LAKE CITY, UTAH—With \$1,000,000 capital, the Salt Lake Light & Traction Company, organized to deal in light, heat and power, has filed its articles of incorporation. O. J. Salisbury, S. A. Whitney, A. H. Parsons, J. B. Walker and C. W. Johnson are the incorporators and directors. Salisbury is president, Johnson is vice-president, Whitney is treasurer, and Parsons is secretary. It is understood the company plans a comprehensive public utility business, including the erection and acquisition of plants for the generation of electricity for power and lighting and steam heat for heating purposes.

FINANCIAL.

LOS ANGELES, CAL.—A meeting of the stockholders of the Southern Counties Gas Company has been called for August 22d, to consider the question of increasing the bonded indebtedness of the corporation to \$2,600,000; present bonded indebtedness, amounting to \$1,000,000.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company announces that, having secured subscriptions for more than 70 per cent of its issue of \$12,500,000 of new first preferred stock, the financial plan outlined in a letter to stockholders dated June 3, 1914, was declared operative at a meeting of the board of directors last week. The subscriptions which exceed \$8,750,000, were received from approximately 3000 subscribers, of whom a great proportion are new stockholders. In view of the disturbed financial conditions, brought about by the European war, and to avoid unnecessary hardships upon subscribers, the company, through its board of directors, has deferred the time of payment of the second installment of \$15 per share from August 15th to October 15th; of third installment of \$12.50 per share from October 1st to November 1st; and of the fourth installment of \$12.50 from January 1 to February 15th. Following is therefore the revised schedule of installment payments on the basis of the sale price of \$82.50 per share authorized by the State Railroad Commission: \$5 per share with subscription; \$15 on or before October 15th, \$12.50 on or before November 15th; \$12.50 on or before January 15th; \$12.50 on or before April 1st; \$12.50 on or before July 1st, and \$12.50 on or before October 1st, 1915.

SALT LAKE CITY, UTAH.—Credence is given to the persistent rumors that the Utah Power & Light Company is considering the purchase of the Utah Light & Railway Company by the presence in Salt Lake City of a corps of accounting experts who are going over the books of the company. Judge Robert S. Lovett, chairman of the board of directors of the Union Pacific system which controls the Utah Light & Railway Company, who is in Salt Lake City, has this to say: "I always refuse to say yes or no to questions concerning the company's negotiations. It is soon enough for me to talk about them after they have been consummated. Such rumors cannot be always honestly denied and it is not good policy to confirm them, and to get around the situation I always refuse to talk about them." The Harriman system purchased control of the Utah Light & Railway Company eight years ago for a consideration of approximately \$3,000,000 and has spent since that time approximately \$7,000,000 on the system. The company furnishes the entire electric lighting, power and street railway service in Salt Lake City and the majority of the lighting and power service of Ogden. The acquiring of this property by the Utah Power & Light Company would give them a virtual control of the entire light and power system in the state of Utah.

ILLUMINATION.

SEARCHLIGHT, MONT.—Place & Donaldson, of Fried, are making arrangements for establishing an electric light plant here.

COLUSA, CAL.—Plans and specifications were approved for the Princeton Lighting District. Bids will be received until September 10th.

CULDESAC, IDAHO.—W. L. Marrs, Coeur d'Alene, recently granted a franchise for a light plant here, expects to start work September 1st of installing a plant.

SOCORRO, N. M.—J. Gordon Lovelace, manager for the Socorro Electric Light Company, has resigned to accept a similar position with the Phelps Dodge Company at Tyrone, N. M.

BURNABY, B. C.—At a recent meeting of the council the engineer reported on a proposed extension of the street lighting system recommending the installation of fifty additional arc lights. This will bring the total installed up to 257.

LOS ANGELES, CAL.—Specifications for an additional lighting system in the Lankershim Lighting District have been adopted by the council and the city clerk has been directed to advertise for bids to be received up to August 24th.

AUBURN, WASH.—The Council has granted a franchise to the Auburn Gas Company, represented by J. L. Veach and contracts for the installation of modern fuel and illuminating gas plant will be awarded. The estimated cost is \$40,000.

DUNCAN, ARIZ.—J. E. Allen, one of the owners of the present electric light plant at Duncan, reports the purchase by himself and associates of a building located in the Head Addition, and the installation in the near future of a complete electric light plant.

SHERIDAN, ORE.—The Oregon Light and Power Company have been awarded a three-year contract for lighting the City of Sheridan. The Willamina Electric Company has been awarded the contract for lighting the City of Willamina for a period of five years.

LOS ANGELES, CAL.—The board of supervisors will receive bids up to August 31st for maintaining lights in Stephenson avenue and Laguna Lighting District, also for installing and maintaining an addition to the system of street lighting in Annandale Lighting District.

FORT BENTON, MONT.—Bids will be received by John F. Murphy, city clerk, up to August 17th for the purchase of \$17,000 in bonds, the proceeds to be used in the construction or purchasing of a light plant for the city. Interest at 5½ per cent. Certified check for \$1000 payable to the city of Fort Benton, required with bid.

OREGON CITY, ORE.—The franchise of the Clackamas County Gas Company to lay mains in the Whitehouse road to Oswego has been granted. The company which is laying the main from Portland to Oregon City, plans to build a line across the river below Milwaukie to Oswego and then back again above the town on the east side of the river.

NOGALES, ARIZ.—A petition is in circulation for presentation to the board of trustees asking the board to rescind its former action postponing for six months consideration of the proposed electric lighting franchise asked by the Nogales Electric Light, Ice & Water Company, and call an election at once to submit it to the people.

REDWOOD CITY, CAL.—Judge B. V. Sargent of Monterey County, sitting for Judge George H. Buck, gave the county judgment against the Spring Valley Water Company

in an action brought by the county to compel the water company to remove its flume, which runs through the main street of San Bruno, six feet above the ground. District Attorney Swart, who represented the county, contended that it was a nuisance, while the attorneys for the water company argued that its right of way had been obtained before the street became a public highway.

FRESNO, CAL.—An arrangement has been tentatively agreed upon to cancel the \$45,600 contract for the installation of the down town electrolier lighting system and substitute for it another under a new call for bids. This agreement has been entered into between City Attorney Lewis H. Smith for the city and S. V. McKenny of Los Angeles for the contractors of Seattle, Wash.

SALT LAKE CITY, UTAH.—By a decision of the State Supreme Court in an opinion handed down last week, the ordinance passed by the city council of Salt Lake City four years ago levying an annual license tax of \$1.00 against each meter in use by the Utah Light & Railway Company is held to be invalid on the ground that it is not uniform in its application, the company having previously declined to comply with it. The right of the city to pass an ordinance requiring such a license fee is upheld by the supreme court and it is announced that the matter of passing an amended ordinance to meet the requirements of the Supreme Court's decision will be laid before the city commission in the immediate future.

TRANSMISSION.

CORVALLIS, ORE.—Lightning set fire to a generator in the Oregon Power Company's substation causing a loss of \$2500.

PELL, WASH.—The Central Light & Power Company, Centralia, are making arrangements for the construction of a new dam here to cost \$18,000.

WENATCHEE, WASH.—The city council has denied the application of the Cashmere Water Power Company for a franchise in the city for a second electric plant.

EDMONDS, WASH.—The Edmonds Light & Power Company has been granted a franchise for the extension of lines in and around Edmonds by the county commissioners of Everett.

PORTLAND, ORE.—A contract for building an electric cable line from Sandy to the Bull Run power plant, has been awarded by the Portland Railway, Light & Power Company to F. L. Mack.

RAYMOND, WASH.—The Willapa Harbor Power Company of South Bend has been granted a franchise to erect poles, string wires and distribute power throughout several townships in Pacific county.

FRESNO, CAL.—The San Joaquin Light & Power Company's two high power transmission lines from Plant No. 1 on the San Joaquin River have been fully repaired since the damage done by the recent forest fire.

HOOD RIVER, ORE.—August Guigard has completed filings with the State Engineer at Salem for the development of 2000 h.p. on Hood River for the establishment of a general electric plant to supply farmers in the vicinity.

SEATTLE, WASH.—At a meeting of the council held during the early part of last week, President Haas introduced an ordinance, requiring all telegraph, telephone and other electric wires to be placed underground, so that private corporations shall not be subject to the penalties for failure to observe this regulation until the city also complies with its terms. It is said that the city has been lax in placing its wires underground while the private corporations have obeyed its terms.

TRANSPORTATION.

SANTA ROSA, CAL.—Sealed bids will be received up to September 10th for the street railroad franchise petitioned for by A. D. Bowen.

EXETER, CAL.—A two mile extension to the Visalia Electric Railroads is to be built at once running from Rose Station to Elderwood.

ALAMEDA, CAL.—City Attorney Samuel Poorman Jr. has been ordered to prepare statistics in the suit of the Oakland & San Francisco Terminal Railways against the city of Alameda to nullify the half-fare ordinance.

BOZEMAN, MONT.—Eugene W. Dawes, Bozeman, is promoting an electric line to traverse Madison and Gallatin valleys, connecting with the Milwaukee and Northern Pacific roads at Bozeman and running west to Yellowstone to connect with the Oregon Short line, a total distance of 150 miles.

CLOVIS, CAL.—In the re-sale of the franchise to construct a street and interurban railroad along the public streets and avenues in this city, bids will be received up to September 1st. The Fresno Interurban Railway Company has presented its application to the trustees for the franchise.

SEATTLE, WASH.—With a view to the abandonment of all proposed extensions to the municipal car lines and the establishment of automobile systems for the carrying of passengers and freight instead, Councilman Erickson, municipal ownership advocate, has introduced a bill, the object of which is to regulate the use and operation of such vehicles.

OAKLAND, CAL.—Announcement has been made that the through train on the Northern Electric and Oakland, Antioch & Eastern Railroad, taken off three months ago, will be put on again soon. The train will leave Chico at 6:20 a. m., reaching Sacramento at 9:00 a. m., and arriving in Oakland at 12:15 p. m. The train will leave Oakland at 5 p. m. and arrive in Chico at 10:35 p. m.

FRESNO, CAL.—Work on the second unit of the Fresno Interurban is scheduled to begin in about ten days, according to Manager R. J. Kelley. The precise date depends upon the arrival of materials and whether or not the company secures the franchise through Clovis that it desires. The trustees of Clovis have passed the ordinance offering a franchise for sale. The franchise, on August 10 will be offered for sale to the highest bidder.

SEATTLE, WASH.—At a council meeting held during the later part of last week an ordinance was introduced amending the private street railway franchise in the south of the city known as the Jackson Street Loop, or Main street line, so that the city may obtain common user rights for its municipal lines. The original franchise was granted in October, 1891, the city reserving at that time the right to amend it. If these common user rights are as it is anticipated, readily secured, the city expects to extend the Lake Burien line from its present terminus in West Seattle to the downtown passenger stations.

SPOKANE, WASH.—The connection of the Washington Water Power Company and the Spokane Traction Company on Boone avenue, by which the Hillyard cars of the Water Power Company will again run north on Hamilton street, from Boone avenue, will begin as soon as the Trent avenue, franchise, which has been delayed from time to time by the council, is passed by them and accepted by the company. Under the settlement now said to have been agreed upon, the Washington Water Power Company is to build the new tracks for the Inland on Trent avenue from Market to Sheridan streets and is also to make the connection on Boone avenue. Steam roads and the city also contribute towards the expense.

SAN JOSE, CAL.—Manager Frank E. Chapin of the Peninsular Electric Company is consulting with Paul Shoup, head of the Southern Pacific Company's electric subsidiaries as to the advisability of abandoning several miles of their electric system between here and Los Gatos by way of Campbell, and also the Saratoga and Congress Spring lines. In the event of these changes, it is stated, the present steam line between San Jose and Los Gatos by way of Vasona Junction and Campbell will be electrified. It is stated that some radical changes are necessary of an enormous shrinkage in the profits of the company, due to the increasing use of the automobile. The enormous number of paying projects going on in San Jose and in outside towns also has been a big financial drain on the Peninsular company.

TELEPHONE AND TELEGRAPH.

SAN BERNARDINO, CAL.—Manager A. E. Scott of the Pacific Telephone & Telegraph Company has announced that the company has authorized \$12,000 for extensions in this city.

BURBANK, CAL.—At a meeting of the board of trustees Arthur Campbell, manager of the San Fernando Valley Home Telephone Company, asked the privilege for his company to construct poles for service on Third street, claiming a franchise before the incorporation of the city.

WHITTIER, CAL.—Improvements and additional equipment to cost about \$10,000, have been announced by A. Wardman, manager of the Whittier Home Telephone Company. Part of the equipment is already on hand, and installation will begin at once.

WINNEMUCCA, NEV.—The application of the Bell Telephone Company to construct its line through the county, coming into Winnemucca along the right of way of the Southern Pacific and leaving via the Western Pacific will be heard at the September meeting of the county commissioners.

LOS ANGELES, CAL.—Preparatory to installing a new fire alarm and police signal system, plans have been prepared for such a system under the supervision of the fire alarm commission. City Electrician Manahan will soon report to the city council so that the council may advertise for bids. The sum of \$200,000 has been appropriated for this work.

TACOMA, WASH.—Charging the Pacific Telephone & Telegraph Company, the Sundel Telephone Company and subsidiary concerns in Washington and Oregon with combining in violation of the interstate laws to put the Northwestern Long Distance Telephone Company of Los Angeles out of business and destroy competition, John B. Coffey, receiver of the Northwestern has filed suit in the Tacoma Federal Court for \$300,000 damages.

SAN DIEGO, CAL.—Manager J. E. Franklin of the Pacific Telephone & Telegraph Company, has announced that his company has authorized the expenditure of \$72,000 in extensions and improvements in San Diego service. Additional work on the Hillcrest exchange to cost \$37,000 is included in the plans and \$21,000 is being expended on a cable to Point Lomas at the present time.

BERKELEY, CAL.—Litigation extending over a period of three years in which the city of Berkeley sought to enjoin the merger of the Home Telephone Company with the Pacific States Telephone & Telegraph Company, was tentatively ended a few days ago when the municipal authorities entered into an agreement of compromise whereby the city is to receive \$20,000 and the free use of 75 telephones. The sum agreed on in compromise will be paid to Berkeley on the installment plan, at the rate of 2 per cent of the annual gross receipts, an average of which is represented in last year's total of \$300,000. By the terms of the agree-

ment, Berkeley will relinquish proceedings to recover the \$25,000 bond forfeiture of the Home company. The negotiations concluded grew out of the absorption of the Home company by the Pacific two and a half years ago, the former company being granted a 50 year franchise in Berkeley in 1907, for which it paid \$47,000.

WATERWORKS.

LOVELOCK, NEV.—L. H. Taylor has been granted a franchise to construct and operate a water system here.

ESCONDIDO, CAL.—The directors of the Escondido Mutual Water Company are considering bids for machinery for two big water power plants to be constructed shortly. Excavation is completed and pipe line construction started.

GLENDORA, CAL.—An ordinance has been prepared calling a special election September 10th for the purpose of submitting to the voters the question of incurring a bonded indebtedness in the sum of \$37,500 for the construction of a municipal water plant.

LOS ANGELES, CAL.—Negotiations for the purchase of the Union Hollywood Water Company's system have encountered obstacles, the outlook now being that Wm. Mulholland's recommendation that the city lay a new system duplicating the Union Hollywood's, may be followed.

SEATTLE, WASH.—Bids will be received until September 7th for the construction of certain additions to the water system of Toppenish, Wash., which will consist of erecting a tank of 75,000 gallons capacity at a height of 105 feet above the ground and the laying of 15,000 feet of cast iron water mains.

ASHLAND, ORE.—The city has authorized the printing of the auxiliary water bonds in the sum of \$175,000 and a special committee of that body has been given power to attend to any necessary details connected with the issue of the same, in order that the legality of the bonds may be beyond controversy.

VAN NUYS, CAL.—Plans and estimates for a distributing system are ready to be presented to the county supervisors, to have an election called for the purpose of forming a district and voting bonds to share the cost of the system. Wm. Mulholland of Los Angeles prepared the plans. A trunk line along the county highway through Calhuenaga pass to Hollywood, has been added to the district which will be served.

SAN FRANCISCO, CAL.—The Works Board is about to purchase more pipe for the high pressure fire protection system. The U. S. Castiron Pipe & Foundry Company has filed a bid offering to supply what is needed at \$26 per ton of 2000 lbs. f.o.b. at point of manufacture. The city has in the corporation yard between 20 and 30 miles of unused high pressure pipe of smaller size than the pipe laid down town. The plan was to use it for outer residential districts. The pipe to be ordered will duplicate the larger sizes now installed, the city officials proposing to have it ready in case of a break. The pipe on hand cannot be used for replacing broken sections, being too small.

SAN FRANCISCO, CAL.—On the annual tour of inspection, made over the Spring Valley Water Company's properties, the board of health went at considerable length into the question of possible pollution of artesian water in the Pleasanton district, should the water company carry out its proposed plan and withhold for realty development the area under which the subterranean streams flow. The trip included a visit to Dumbarton and a tour of the lakes. Crystal Springs, San Andreas and Pilarcitos, with a stop at the Crystal Springs cottage. The party visited Sunol, Pleasanton and the great Calaveras dam, now partially completed, where, when finished, 63,000,000,000 gallons of water will be impounded. At all the sources of water samples were taken for analysis.

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Devoted to the Conversion, Transmission and Distribution of Energy

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SAN FRANCISCO, AUGUST 29, 1914

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HOMESTAKE HYDROELECTRIC POWER PLANT.

BY RICHARD BLACKSTONE.

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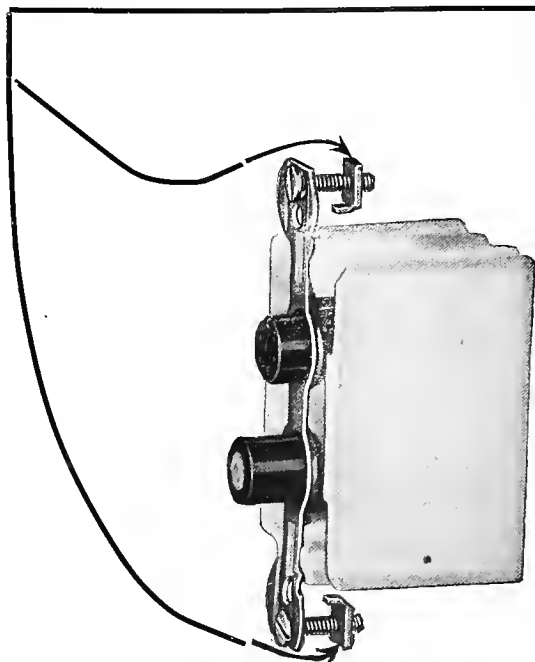
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HOMESTAKE HYDROELECTRIC POWER PLANT

BY RICHARD BLACKSTONE.

(This description of a 6000 kw. hydroelectric power plant is of peculiar interest because practically all of the power is consumed by one mine, for which the author is chief engineer and assistant superintendent. It is condensed from an article originally published in the Mining World of Chicago, to whom we are indebted for the use of the illustrations. The Editor.)

To secure electric current for operating its mills, mine pumps, etc., the Homestake Mining Company, Lead, S. D., has developed a water power of 6000 kw. capacity from the fall of Spearfish Creek. It has a working head of 665 ft.

The precipitous sides of the canyon, and the great length of the contour, led to the conclusion that a tun-

nel construction nor certain of cutting off all the water. A much more favorable location could have been made about 2000 ft. down stream, with rock exposed in the creek bed, and a narrow gorge to close to, at about the same cost as the upper one; but the Chicago, Burlington & Quincy railway track upon the ground interfered with this plan. Had the valley been clear of



General View of Homestake Pipe Line Showing Power House and Pressure Pipe From Standpipe.

nel, as a conduit, was the only satisfactory means for conveying the water to the forebay. A lumber flume could not be considered owing to the rugged nature of the mountain slopes. The diversion of the water had to be limited to the property lines, and, in order to get the most out of the water, the intake was located at the upper line. This location fixed the diversion upon a wide stretch of gravel, not favorable to cheap

the railroad, a dam at this point, raising the water to the grade elevation, could have made a storage reservoir of considerable value as a regulating supply.

The dam is of concrete, 400 ft. long. It rests on the gravel bed above mentioned, solidified by sheet steel piling driven to blue shale. It is 25 to 30 ft. wide at the bottom, and tapers to the usual apron at the top. There are there spillway openings each 12

ft. wide, with flash-boards arranged in 4-ft. panels, which raise the level another 2 ft. These are framed in steel posts extending up from the body of the dam.



Intake Head Gates With Trash Rack Supports.

The diversion near the property line being determined upon, the intake was located some 8 ft. below the natural bed of the water flowing in the creek. To lower the ground water below the tunnel floor, and also to allow the excavation for the dam to be freed from water to as low a point as possible, a drain ditch was excavated cutting the tunnel line about 25 ft. below the railroad track, and about 1350 ft. long. In the bottom of this was laid a heavy wood box 2 by 2 ft., to a flat grade and back-filled with material from the excavation. The excavation for the dam was made to the depth mentioned. Not finding continuous rock crossing the valley of the river bed, and as a further precaution against seepage through the gravel, continuous lines of Carnegie interlocking steel-sheet



Headgates to Redwood Pipe and Two Sets Screens.

piling was driven upon the shales in the tunnel and the shales on the easterly side of the river, as a cut-off wall.

The excavating for the dam was carried on from one end continuously, followed by the driving of the steel piling; then concrete was deposited in the dam in still water, by bulk-heading with plank driven into the bottom of the excavation on both sides of the piling, leaving the space about the pile heads open. The water ran off through the drain ditch. This part of the concrete was carried above the water line. When set, the planking was removed, the water shut out of the trench left about the piles, and concrete

then filled in between the piles up to the level of the concrete base already placed.

As a part of the dam and head works, a foundation for the support of the Burlington tracks was made forming a buttress for the steel span of the railroad, the tracks being diverted temporarily to the grade bed of the river, while the excavation under the main line of the railroad was carried on. The track was in due course restored, with no interference to traffic whatever.

As a whole, the river bed was gravel and sand of class suitable for construction work; the material excavated from the dam was sent direct to the crusher and mixer, the cement added and the same material returned as concrete to the dam. The plant for the concrete work consisted of two Smith mixers, each $\frac{1}{2}$ -yd capacity, and Atlas Portland cement was used. For crushing rock and boulders Gates crushers were employed. Sand was found in bars along the creek and added to that screened from the crusher.

From the side of one bank just above the dam, the water enters the intake of a tunnel extending in practically a straight line 23,800 ft. in the direction of the power house. This has a width of $6\frac{1}{2}$ ft., vertical side walls of a height of 5 ft., with an arched roof of 3 ft. 3 in. radius. It is protected by trash racks and closed at the intake by four 4 by 2 ft. cast iron gates made in the Homestake foundry and shop. The tunnel was driven through solid rock in sections, cross-cuts being made through the hill from suitable points along the route. The sides and floor of the tunnel are lined with concrete, and the arched roof is similarly lined for about three-fifths the distance.

Preliminary to the driving of this tunnel it was determined to use electric energy in the work. The Homestake Mining Company was the owner of a hydroelectric power plant near the northerly end of the tunnel, on Spearfish Creek. This plant was built in 1904 for the purpose of lighting Spearfish town. It was equipped with one 100-kw., 2300-volt, alternating-current Westinghouse generator. The water power was supplemented by a steam plant sufficient to carry the loads when freezing weather cut off the water. This electric output was used not to exceed 8 hours out of 24. Another 100-kw. Westinghouse generator of the same voltage was installed, so both could be run in multiple.

A transmission line was built up the valley to the intake, with branches to each station. Transformers were erected as near the tunnel entrance as convenient, stepping down current to 220 volts, with leads to the Temple-Ingersoll electric drills at the working faces of the tunnels, and to the Sirocco blowers, which furnished the ventilation to the miners working in the tunnels. It was also used to pump water from Spearfish Creek to the several tunnel stations.

It may be of interest to note that the maximum metered power used in driving this tunnel seldom exceeded 30 h.p. The power used was metered, and a daily report made of the current put on to the tunnel transmission line.

The ventilating was accomplished by means of Sirocco fans having a capacity of 500 cu. ft. per min., through 2000 ft. of $9\frac{1}{4}$ -in. galvanized iron pipe made on

the ground from sheets delivered there. These were put together with slip joints and sealed with muslin asphalted to the pipe. The pipe was kept within 200 ft. of the face of the drift extension, wood boxes being used at the discharge ends as protection against flying rocks from the blasting and to carry air near to the face of the tunnel.

The tunnel terminates in an open concrete forebay, 40 by 70 ft., with overflow weir. The entrance from this to the pressure pipe, like the main intake, is protected by trash racks of 1-in. mesh wire screen, made in sections and removable, and two 4 by 4 ft. gates which, with the hoisting screws, were made in the Homestake shops. These, like the other gates, are hand-operated.

From the concrete forebay the water which has a flow of 40 to 120 cu. ft. per sec., depending on the



Forebay Taking Discharge From Tunnel.

water stage in the creek, passes to 1200 ft. of the redwood stave pipe line in two lines as an invert, the lowest point working under a head of 110 ft. The lines begin in steel flanges embedded in the concrete. They are composed of redwood stave pipe 48 in. inside diameter, banded with $\frac{1}{2}$ and $\frac{5}{8}$ in. mild steel bands, with a tensile strength of from 55,000 to 65,000 lbs. The $\frac{1}{2}$ -in. bands are spaced on maximum centers on 10 in., and minimum 4 in., for heads up to 56 ft., while the $\frac{5}{8}$ -in. bands are spaced on maximum centers of 10 in., and for heads up to 110 ft. The staves were finished $1\frac{1}{8}$ in. for the lower and $2\frac{1}{2}$ in. for the higher heads.

The pipe was fitted with 26 deg. $\frac{3}{8}$ -in. plate steel elbows, with hubs on both ends for staves, and each elbow provided with a standard 8-in. flange to connect with 8-in. blow-off. This pipe was built of staves milled from clear California redwood free from sap, knots, shakes, pitch or pitch-seams, of the best grade of lumber for the purpose. The staves came accurately milled to true radial lines for the diameter required and fitted with steel tongues for butt joints. These tongues set into kerfs on the ends of the staves, forming tight joint. The steel bands were dipped in an asphaltic coating to protect against corrosion, but the staves were not, as such redwood pipe requires no protection against decay, either under or above ground. This line has shown no deterioration, being still in excellent condition.

The shoes holding the bands are of malleable iron of the Allen type for the $\frac{1}{2}$ -in. band, and the Gazelle pattern for the $\frac{5}{8}$ -in. band.

The direct line from the forebay to the power house passed over a small hill or mound, the apex of which was over 110 ft. above hydraulic grade line, and this made it necessary to erect some sort of reservoir with open connections to the air at that point. As a substitute, a large steel cylinder 74 in. in diameter by 25 ft. long, with four open-stand pipes, each 36 in. in diameter and 54 ft. high, was determined upon. The two lines of wood-stave pipe enter this cylinder from tapering nozzles at the ends. The three pressure pipes are joined to it on the side by flanged tapering connections.

A special wind brace consisting of a 4-post steel tower, anchored to heavy concrete piers, was built sufficiently strong to hold the stand pipes against any wind that might come, from an ordinary blow to a tornado, the pipes themselves not having stability or stiff-



Route of Pressure Pipe Line.

ness enough to be safe against wind storms. These pipes provide for the escape of air accumulating at the high points of the line and also pick up any surges that may occur.

The discharge openings of the cylinder are 40 in., tapered to the 34-in. flanges to three lines of pressure pipe, totaling 12,164 ft., which are 34, 32 and 30 in. in diameter. The larger sizes are spiral riveted pipe, and the 30-in. size is welded pipe. Starting from the cylinder there is, for each line, a 34-in. Crane gate valve. To this the first length is connected, aggregating 1467 ft. of 34-in. No. 8 gauge pipe. Then comes 1937 ft. of 32-in. No. 6 gauge pipe. Forged steel compression couplings were used throughout, the pressure provided for at the lower end of the 34-in. pipe being 57 lbs., and at the end of the 32-in. pipe 135 lbs. To the spiral rivetted pipe is connected 2100 ft. of 32-in. lap-welded pipe, $\frac{5}{16}$ in. thick joined by forged-steel flanges, except every fifth length, where forged-steel compression couplings are used to take care of expansion. The pressure provided for at the lower ends of this pipe is 185 lbs. Then follows 5030 ft. of 30-in lap-welded pipe $\frac{7}{16}$ in. thick, with flanged joints and couplings similarly arranged, the pressures provided for at their lower ends being 287 lbs. All of the welded pipe was made from low-carbon, open-hearth steel, having a tensile strength of 54,000 to 60,000 lbs. per sq. in.

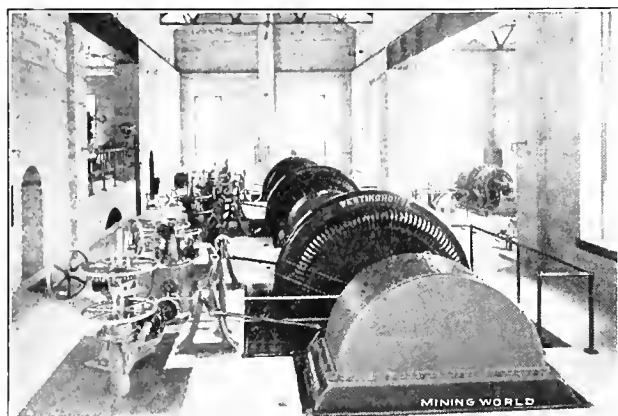
In the 34-in. line there were placed six bends ranging from 7 to 16 deg.; in the 32-in. line, three bends of 7 deg. each, and in the 30-in. line 10 bends of from 11

to $22\frac{1}{2}$ deg., all being made up in the form of flanged elbows. All other bends in the line are five degrees or less, and were taken care of by setting the flange at the required angle on the pipe.

The entire lot of material was thoroughly asphalted by the makers inside and out. Each and

above expansion joint, heavy iron rods, inserted into one hole of the flange on each side of the pipe, lead to concrete anchors, insuring against any creeping of the pipe down hill.

Water enters the power house through the three Y branches of the 30 in. welded pipe, each of which di-



Pelton Wheels and Governors Connected to Westinghouse Generators.



34-in. Pressure Line Leaving Cylinder, Showing Gate Valves and Air Intakes.

every length of pipe was tested to 50 per cent in excess of the required working pressure. The test pressure was stamped on the edge of the flange of each piece.

The pipe lines followed the surface of the ground, the beds for the pipe being graded in stretches. Changes of grade were made at points that provided for economy in grading. The pipes are all laid on concrete shoulder foundations, making them absolutely safe against settlement or side movement. After test-

vides; and the water impinges through 6 in. nozzles directly upon the two runners of an overhung Pelton impulse turbine, the wheels of which are placed on either side of the electric generator which it drives.

There are three of these power units, the generator in each case being a Westinghouse machine rated 2000 k.v.a. or 1600 kws. at 80 per cent power factor, and capable of standing 25 per cent continuous overload. Alternating current, 3-phase, 60-cycles, is generated at a terminal pressure of 2300 volts. Excitation of the field coils is effected from two 125 kw., direct current generators, each of which is connected to a Pelton water wheel, and also to a Westinghouse motor.

When one of the exciters is started up, it is driven from the Pelton wheel; but may be, as desired, switched over to the motor-drive on alternating current from the main generating system. Water is admitted to the exciter wheels through independent feed lines which, through a cross-connecting main and suitable gate valves, can take their supply from any one of the penstocks feeding the main units.

The transformer house above referred to, forming one leg of the "H," is located over the penstocks. It contains ten 666-7 k.v.a. oil insulated, water cooled Westinghouse transformers, arranged in three banks, all being wound for 33,000 volts on their high potential side. Current, as generated at 2300 volts, is led to the double bus bar system of the switchboard, thence to the transformers, stepped up to 33,000 volts, and from there sent over the transmission lines to the substation at Lead, 11 miles distant.

The Transmission Line.

There is a double transmission line, consisting of two complete 3-wire circuits, the six wires being of No. 2 hard drawn copper. A No. 4 copper-clad ground wire is carried on top of poles and two No. 12 copper-clad telephone wires. The insulators, furnished by the Ohio Brass Company, will stand under 45,000 volts. The upper cross arms, $4\frac{1}{2}$ by $5\frac{3}{4}$ in., are each $11\frac{1}{2}$ ft. long; the lower ones, having the same width and thickness, are each $8\frac{1}{2}$ ft. long. The line is 11 miles



Pressure Lines, Cylindrical Receiver and Standpipes.

ing all pipes and joints to our entire satisfaction, the pipe was covered.

The Power House.

The power house is a concrete structure in the shape of the letter H, the main generating plant forming one leg, the switchboard room the connecting bar, and the transformer house the other leg. The pipe lines pass under the transformer and switchboard rooms to the generating room through the basement. This piping is all exposed, showing all joints to be absolutely water tight under 665 ft. head, or 288 lbs. per sq. in. The joints are flanged and bolted with rubber gaskets. Expansion joints were provided about every 250 ft. for the entire length; also from the flange next

long. It includes 420 cedar poles, with an average span of 134 ft. One circuit has capacity to carry the whole current output from the generators with small loss, allowing the other to be cut out and grounded while repairs are being made.

This transmission line delivers the whole output of the Spearfish generating station to the bus bars of the Lead substation. The substation at Lead is a model of electric equipment for receiving and distributing electric energy. Is equipped with lightning arresters located on the roof of the building, high tension oil switches for the control of the lines, three sets of step-down transformers, a switchboard completely equipped with indicating and graphic meters, power factor meters, frequency meters, and everything known to electric plant designing and operating engineers.



Redwood Stave Pipe Installation, Showing Pressure Equalizing Standpipe in Background.

Distribution of Power.

From the substation the power is distributed to the various plants of the Homestake that are operated by electricity. Three sets of General Electric transformers, each set or bank having 2000 k.v.a. capacity, step down the current to 11,000 volts, to 2300 volts, and to 440 volts.

The 11,000 volt current is retransmitted to Terryville and Central City stamp mills, and to the rock crushers at Old Brig and Golden Prospect hoists. At these hoists it is stepped down to 2300 volts, and drives seven 35 h.p. General Electric fly wheel motors to

which are belted the No. 6 Gates crushers at these hoists. Branches of this circuit lead current to the local transformers which are separately housed near each mill. Here current is stepped-down to 440 volts, with leads directly to the mill motors in the Poca-hontas 160-stamp mill, and the Monroe 100-stamp mill at Terryville; also to the Mineral Point 100-stamp mill at Central City. The local lighting is also taken from this circuit.

The 2300-volt circuit out of the substation drives the six 125-h.p. General Electric fly-wheel motors, belted to the six Gates No. 6 crushers at the Ellison hoist and the four Gates crushers at the B. & M. hoist. It is also carried down the B. & M. shaft and drives the seven 125-h.p. Westinghouse motors that are directly connected to Jeanesville, double-suction 3-stage pumps, each having a capacity of 1000 gals. per min., against 315 ft. head; also three 75 h.p. motors direct connected to Jeanesville 2 stage pumps of 500 gals. capacity, working auxiliary to the main pumps. A branch is carried to the regrind, consisting of four horizontal tube mills. Each mill has its own motor, and drives through reducing gear to proper speed. The circuit leads on to a Jeanesville turbine pump at the clarifying reservoir, equipped with a Westinghouse 125 h.p. motor direct connected, having a capacity of 1000 gals. per min. against a 300 ft. head. This pump is of the same class and type as the mine pumps. The 2300 volt circuit is carried still farther to the Homestake Cyanide No. 1, where it is applied to driving air compressor, solution pumps, and lighting the plant.

The remaining bank of transformers in the Lead substation, steps down from 33,000 volts to 440 volts, and the current is led by heavy stranded copper cables to the Lead stamp mills, each having its own feeder, and from a central point in the mill, divided to the 25 h.p. induction motors driving the stamps. All of the 102 induction motors driving the Homestake stamp mills are of the same make and capacity, have same speed sized pulleys and are belted by 16 in. leather belts to 90 in. cam shaft pulleys, so that all stamps are driven at the same speeds. By having motors all same standard construction repairs are more readily made and mill men better understand their care than if of various types.

Since this power system was started up, it has been in continuous operation with no interruption whatever to the service, and every detail of it is giving entire satisfaction to the management.

Luminous organisms, such as the fire-fly, give light because of the oxidation of some complex physiologic product, probably a nucleo-albumin according to F. A. McDermott in the Transactions of the Illuminating Engineering Society. The fire-fly expends all the energy used in light production within the range of the visible spectrum, there being no infra-red nor ultra-violet rays. The efficiency is about 0.054 watts per candle, about ten times as great as the nitrogen-filled tungsten lamp. The luminous tissue of the fire-fly may be dried in a vacuum without losing its power to produce light when moistened, even after two years have elapsed.

ELECTRIC DISTRIBUTION

ELECTRICAL STANDARDS IN SAN DIEGO.

BY L. M. KLAUBER.

D. Overhead Construction.

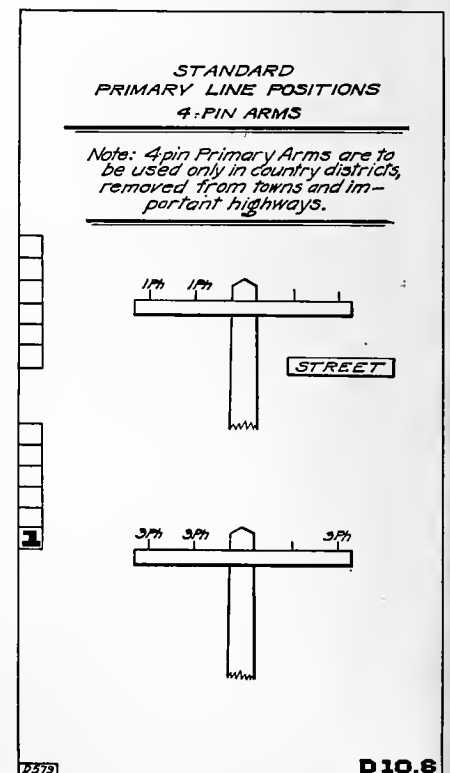
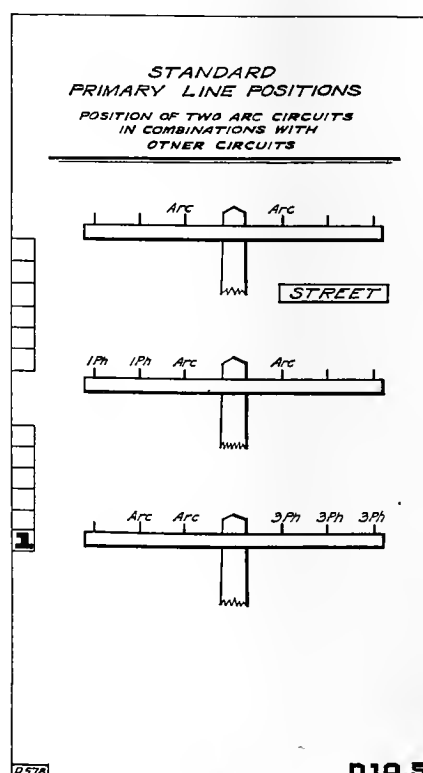
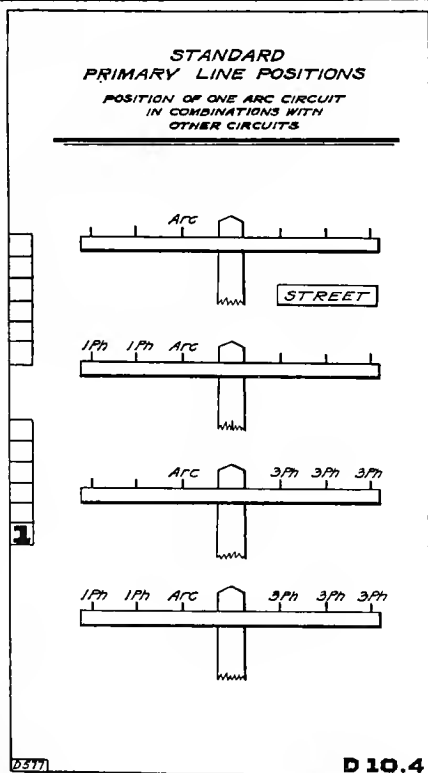
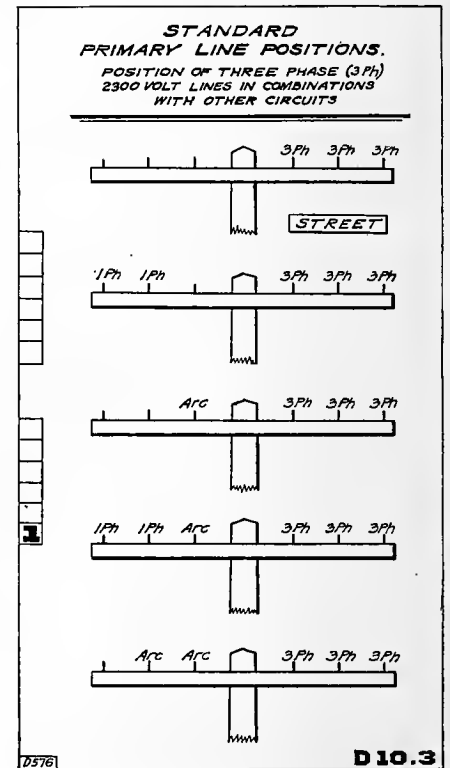
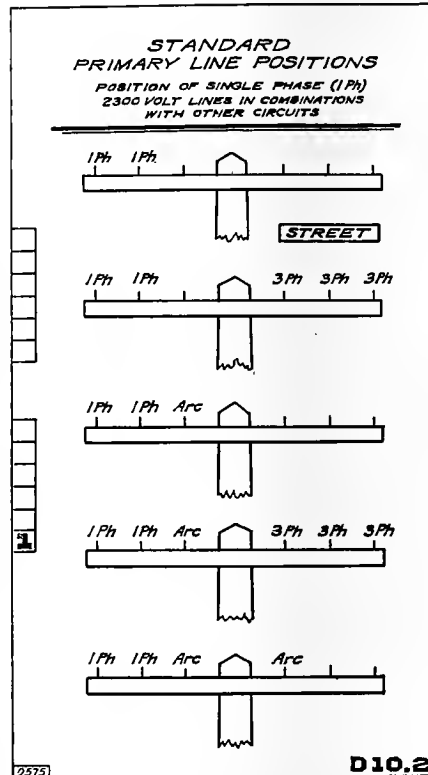
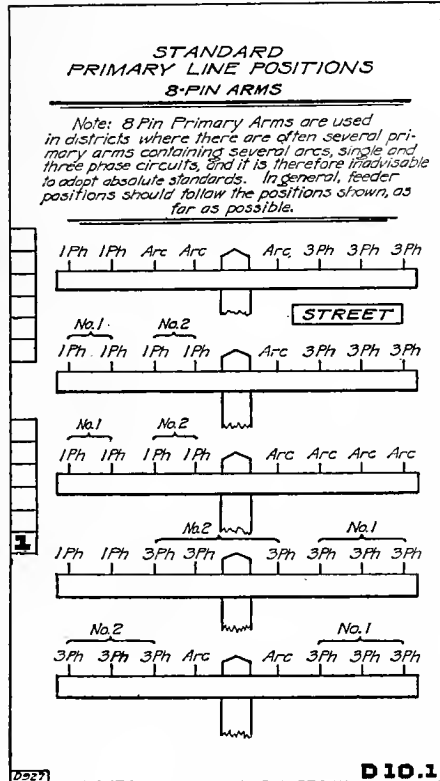
Section D covers all overhead work except the hanging of arc lamps and transformers which are treated elsewhere. The items considered are as follows:

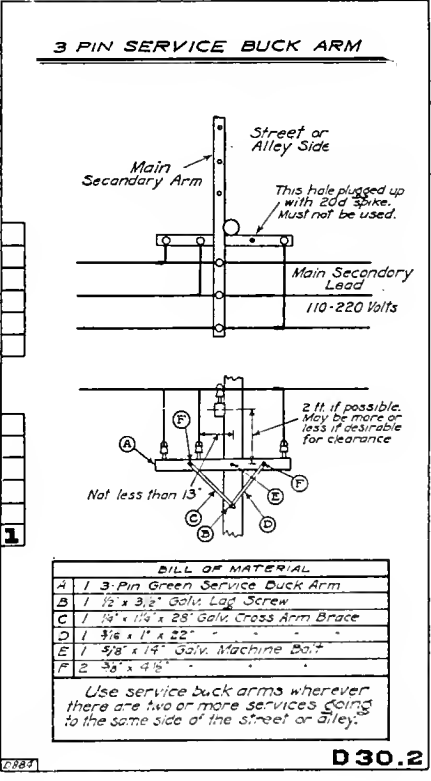
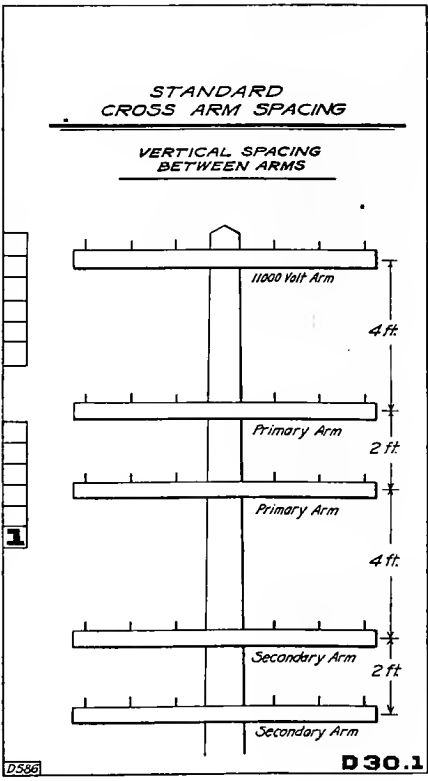
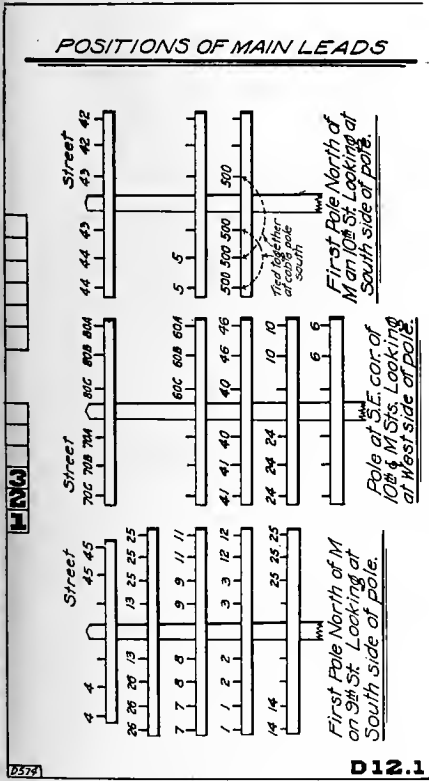
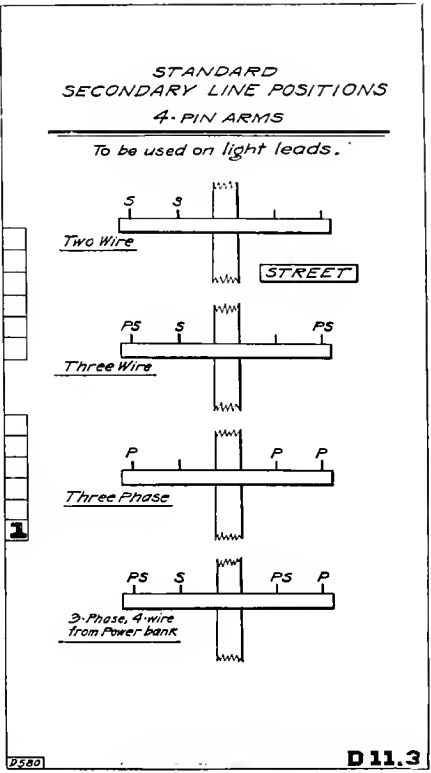
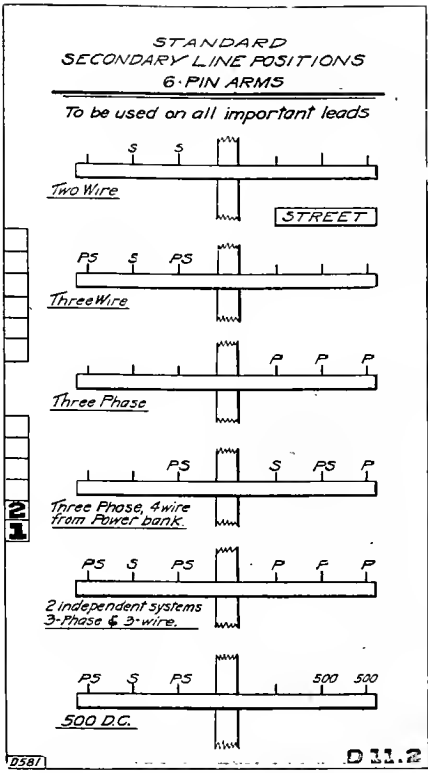
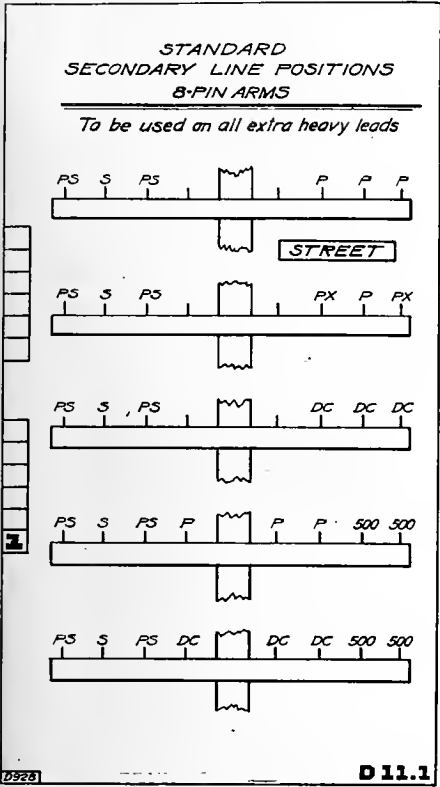
- D 10 Positions of Lines on 8-Pin Arms. D 50 Guying, Bracing and Reinforcing.
D 20 Pole Setting. D 60 Ties.

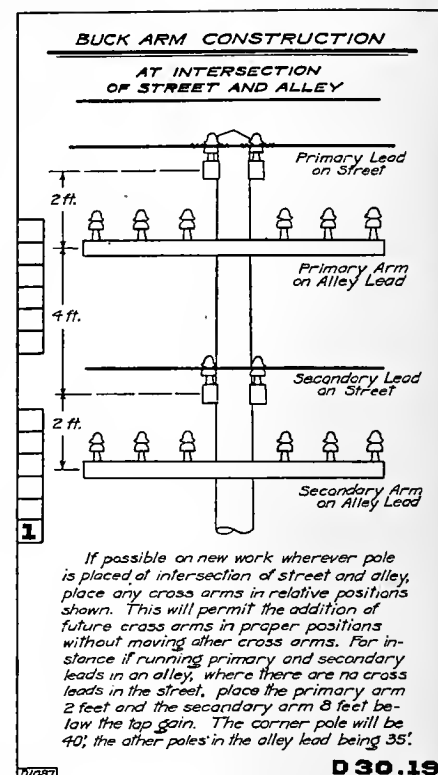
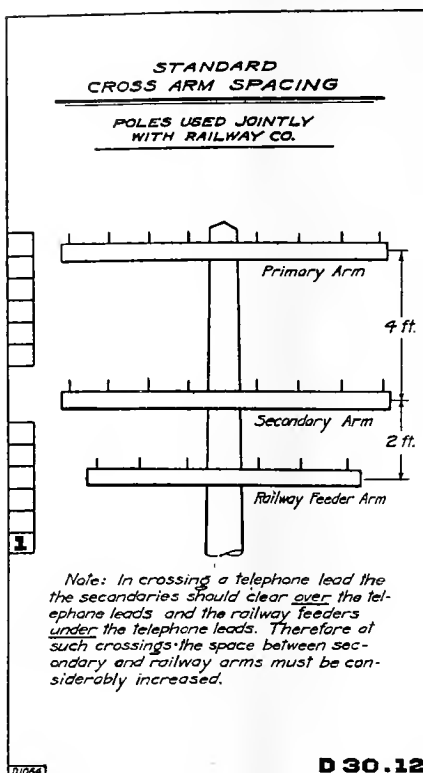
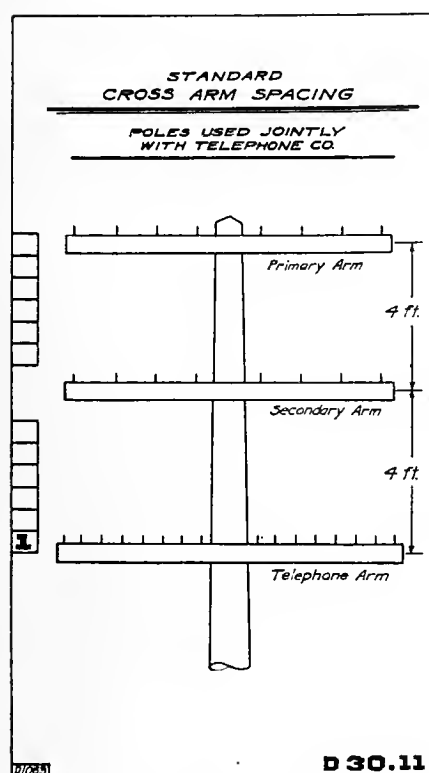
- D 30 Arm Spacing.
D 40 Crossings.

- D 70 Lightning Arresters.
D 80 Switches.
D 90 Miscellaneous.

D. 70: Positions of Lines on Arms. This subject is covered by the nine sheets reproduced herewith. Sheets D 10.1 to D 10.6 cover primary work. It will be noted that as a general rule 2300 volt single-phase feeders take the street side and municipal arc circuits the pole positions. The latter are placed nearest the







pole, since, as they are dead in the day time this arrangement permits freer climbing of the pole. Eight pin yellow arms are standard for primary work along heavy leads; six pin yellow arms are standard in residence districts.

Sheets D 11.1 to D 11.3 cover secondary work. The meaning of the letters placed above the pins will be evident from Sheets A 40.1 to A 40.5. (See Journal for August 15th, p. 146.) In general, it is the intention to place the lighting secondaries on the walk side and the power secondaries on the street. Six pin green arms are standard except in districts covered by the direct current circuits where eight pin are used. Four pin green arms are often used in farming districts where both light and power are fed from a single transformer bank. (See Sheet A 40.3, central figure.)

Sheet D 12.1 shows the positions of feeders at the cable poles leaving the central station. Sketches similar to this showing feeder positions on important leads are often of value to foremen and troublemen.

D 20: Pole Setting. This division lists the N. E. L. A. standard pole setting as shown in the table. In adobe soil the setting for curves is used on straight line work.

D 30: Arm Spacing. The standard spacing shown in D 30.1 was devised to comply with Statute 499. In ordinary leads there is a single primary arm occupying the top gain and a secondary arm four feet below.

The service buck arm illustrated in Sheet D 30.2 utilizes secondhand four pin arms, which, being less than 26 in. between pole pins can no longer be used as line arms under the present law. These arms are repainted and redrilled eccentrically as shown. This permits the use of an obsolete 22 in. brace. The arm is attached to the walk side so that the greatest pull is against the pole.

The spacings on joint poles as shown in Sheets 30.11 and 30.12 are not rigid standards, being subject to more or less variation to secure proper crossing clearances.

The buck arm construction shown in D 30.19 is so arranged as to produce the minimum change of grade in the crossing lines. As the standard street poles are 40 ft. and the alley poles 35 ft. the maximum change of grade is in the secondary on the street, which drops 2½ ft. at the buck pole.

The Cottrell process for electrical precipitation of smelter fumes consists in the conversion of a high-tension alternating current of 30,000 to 60,000 volts into a direct intermittent current of the same potential, and the application of this current to certain electrodes suspended in a flue conveying the gases to be treated. These electrodes in their simplest form consist of narrow suspended metal plates regularly spaced 5 to 12 in. apart, depending on voltage, and between adjacent plates, parallel and equidistant from them, is stretched a fine wire to every space, the wires forming the discharge electrodes and the plates the collecting electrodes. There is thus maintained through a silent or glow discharge an electrically charged field through which the gases travel and all dust or condensed fume or moisture becoming electrified is deposited on the plates. In the plant of the Balakala Consolidated Copper Company at Coram, Cal., the recovery of solids was usually from 80 to 90 per cent, an attainment not sufficient to meet the demands of the courts. Tests with a 50,000 cu. ft. per min. converter-gas treater at Garfield, Utah, gave an average recovery of lead fumes of 97.25 per cent and of gas from 95 to 100 per cent.

EFFICIENT POWER PLANT MANAGEMENT

CORRESPONDENCE FILING CLASSIFICATION

[Continued.]

300—Electricity.

302—Design and Construction Details—Specifications—Contracts—Bids.

(Note:—File under the specific equipment or thing involved, if possible.)

310—Proposed Extensions.

- 310.1—Cost Analysis and Unit Costs.
- 310.2—Valuation—Preliminary Reports.
- 310.3—Investigations.
- 310.4—Location.
- 310.5—Program of Work.

311—Tests and Inspection.

(Note:—File under the specific equipment or thing involved, if possible.)

320—Generation and Transformation of Electricity.

321—Generators—Exciters—Rotary Converters.

322—Switchboards—Switching Apparatus—Accessories

- 322.1—Line Switches.
- 322.2—Station Switches.
- 322.3—Customers' Service Switches.

(Note:—Where switches, apparatus, etc., are spoken of in connection with switchboards, put in file 322.2.)

323—Voltage Regulating Apparatus—IRT Regulators—Tirrell Regulators.

324—Transformers—Transformer Oil and Accessories.

- 324.1—Grounding of Secondaries and Cases.
- 324.2—Filter Presses and Filter Paper.
- 324.3—Light and Power Transformers.
 - 324.31—Transformer and Line Voltages—Methods of Connecting.
- 324.4—Current and Potential Transformers.
- 324.5—Arc Lighting Sets—Constant Current Transformers—Arc Lighting Regulators—Arc Tubes.

325—Motors.

329—Other Electrical Equipment.

- 330.1—Repairs, Reconstruction, Etc.

331—Overhead Supporting Structures.

- 331.1—Poles.
- 331.2—Cross Arms.
- 331.3—Pins and Insulators—Insulator Brackets.
 - 331.35—Roof and Wall Bushings—Entrance Tubes.

331.4—Hardware—Guy Cable—X Arm Braces—Bolts—Washers—Lag Screws—Solder.

331.5—Special Structures—Steel Towers.

332—Underground Systems.

- 332.2—Conduits and Accessories.
- 332.3—Manholes and Accessories.

333—Conductors and Accessories.

333.1—Conductors—Wires—Aluminum, Copper and Other Electrical Cables.

333.11—Insulation of:

(For porcelain and glass line insulators, see 331.3.)

333.13—Reels for Wire or Cable.

333.2—Tap-Offs—Sleeves—Joints.

333.3—Trolley Frogs—Crossings—Other Specialties

334—Lightning Arrestors and Lightning Protection.

335—Electric Meters.

- 335.1—Repairs.
- 335.2—Testing and Inspection.

340—Telephones and Telegraphs (Signalling Systems—Fire Alarms.)

350—Operating Data—Methods.

351—Operating Data—Station Records.

- 351.1—Power Purchased or Sold—Data Relating to

352—Operating Methods.

- 352.1—Rules and Regulations.

359—Troubles and Characteristics of Operation.

(Note:—File under the specific equipment or thing involved if possible.)

360—Utilization.

361—Lighting Devices—Lamps and Fixtures.

- 361.1—Arc Lamps.
- 361.2—Incandescent Lamps.
- 361.3—Nernst Lamps.
- 361.4—Mercury Vapor Lamps.

362—Interior Illumination.

- 362.2—Interior Wiring.
 - 362.21—Circular Loom, Porcelain Tubes, Knots, Cleats, Cut-Outs, Fuses, Snap Switches and other Interior Wiring Devices.

363—Street Lighting.

- 363.1—Maintenance—Municipal System.
- 363.2—Cluster and Other Ornamental Systems—Ornamental Posts.

364—Electric Signs and Outline Lighting.

365—Cooking, Heating and Household Appliances.

- 365.1—Electric Ranges.
- 365.5—Other Cooking Appliances.
- 365.6—Laundry and Washing Machines.
- 365.7—Vacuum Cleaners.
- 365.8—Other Household Appliances.
- 365.9—Heating Appliances.
 - 365.91—Electric Irons.
 - 365.92—Electric Soldering Irons.
 - 365.93—Water Heaters.

366—Power (Loads; Different Kinds of Service.)

- 366.1—Irrigation Power and Motors and Pumps of Electric Pumping Customers (Includes motors and pumps of irrigation customers.)
- 366.11—Tests—Inspection—Data.
 - 366.111—Soil Characteristics—Water Duty.

366.2—Flour Mill Power and Motors for same.

366.8—Industrial Power and Motors for same.

- 366.81—Tests—Inspection—Loads—Data.

367—Electro-chemical Uses.

- 367.1—Storage Batteries—Dry Cells and Other Electric Cells.
- 367.2—Electro-plating.

369—Other Uses of Electricity.

- 369.1—Fans.

400—Gas.

402—Designs and Construction Details—Specifications—Contracts—Bids.

(Note:—File under the specific equipment or thing involved, if possible.)

410—Proposed Extensions.

- 410.1—Cost Analysis and Unit Costs.
- 410.2—Valuation—Preliminary Reports.
- 410.3—Investigations.
- 410.4—Location.
- 410.5—Program of Work.

411—Tests and Inspection.

(File under the specific equipment or thing involved, if possible.)

420—Generation of Gas.

421—Generating and Purifying Apparatus.

- 421.1—Benches and Other Generating Devices.
- 421.3—Purifying Apparatus.
 - 421.31—Condensers (for Gas Plants.)
 - 421.32—Scrubbers.
 - 421.33—Purifiers.
 - 421.34—Ammonia Washers.

- 422—Conveying—Storing and Measuring Apparatus.
 - 421.35—Wash Boxes.
 - 422.1—Exhausters—Compressors.
 - 422.3—Coke Ejectors.
 - 422.4—Holders and Gas Storage Tanks.
 - 422.5—Governors.
- 424—By-products.
 - (For Coke, see 731.4.)
 - 424.2—Tar and Ammonia.
 - 424.21—Storage Tanks and Wells.
 - 424.5—Lamp Black and Briquettes—Graphite.
 - 424.9—Other By-products.
- 430—Transmission and Distribution Systems.
 - 430.1—Repairs—Reconstruction, Etc.
- 435—Gas Meters.
 - 435.1—Repairs.
 - 435.2—Testing.
- 450—Operating Data—Methods—Supplies.
 - 451—Operating Data—Station Records.
 - 452—Operating Methods.
 - 452.1—Rules and Regulations.
 - 459—Troubles and Characteristics of Operation.
 - (Note:—File under the specific equipment or thing involved, if possible.)
- 460—Utilization.
 - 461—Lighting Devices—Burners and Fixtures.
 - 461.1—Gas Arcs.
 - 462—Interior Illumination.
 - 463—Street Lighting.
 - 463.1—Maintenance of Municipal Systems.
 - 463.2—Ornamental Posts, Etc.
 - 464—Gas Signs.
 - 465—Cooking—Heating and Household Appliances.
 - 465.1—Gas Ranges.
 - 465.2—Hot Plates—Toasters.
 - 465.3—Irons (Sad, Soldering, Etc.)
 - 465.4—Water Heaters and Other Heaters.
 - 465.5—Ovens and Furnaces.
 - 466—Other Uses of Gas.
- 500—Water and Hydraulic Works.
 - Note:—1. In the case of a hydroelectric development, the matter as a whole shall be considered as hydraulic works, but correspondence relating to specific things shall be filed independently. Thus, letters relating to a hydraulic feature of the development shall be filed under the 500 series; letters relating to a feature of the powerhouse structure shall be filed under the 120 series; and letters relating to electric details of the development shall be filed under the 300 series.
- 501—Water Rights and Agreements—Water Appropriations—Sources of Water Supply.
- 502—Design and Construction Details—Specifications—Contracts—Bids.
 - (Note:—File under the specific equipment or thing involved, if possible.)
- 510—Proposed Extensions.
 - 510.1—Cost Analysis and Unit Costs.
 - 510.2—Valuations—Preliminary Reports.
 - 510.3—Investigations.
 - 510.4—Location.
 - 510.5—Program of Work.
- 511—Tests and Inspection.
 - (File under the specific equipment or thing involved, if possible.)
- 520—Hydraulic Works.
 - 526—Dams and Reservoirs.
 - 527—Canals and Flumes.
 - 529—Other Hydraulic Works.
 - 529.1—Wells (Not Irrigation.)
- 530—Transmission and Distribution Systems.
 - 530.1—Repairs—Reconstruction—Etc.
- 535—Water Meters—Weirs.
 - 535.1—Repairs.
 - 535.2—Testing.
- 550—Operating Data—Supplies—Methods.
 - 551—Operating Data—Station Records.
 - (Note:—File under the specific equipment or thing involved, if possible.)

552—Operating Methods.

552.1—Rules and Regulations.

554—Pollution and Purification of Water.

554.1—Water Analyses.

559—Troubles and Characteristics of Operation.

(Note:—File under specific equipment or thing involved, if possible.)

560—Utilization.

Note:—Irrigation customers are considered as electric customers. Correspondence relating to them or their equipment will therefore be filed under the 360 series.)

562—Domestic and Commercial Uses.

563—Water for Municipal Uses.

563.1—Maintenance of Municipal Systems.

564—Industrial Uses.

566—Water Motors.

580—Ice.

Manufacture of Ice, Etc.

580.1—Manufacture of Ice.

580.2—Operation of Plant.

580.3—Sales of Ice.

580.4—Storage of Ice.

580.5—Quality or Quantity.

581—Troubles and Characteristics of Operation.

[To be continued.]

Melting of cathode copper in the electric furnace was the subject of a paper presented before the Salt Lake meeting of the A. I. M. E. in August, by D. A. Lyon and R. M. Keeney. Its success in the steel industry suggests its substitution for reverberatory smelting, which is shown to be superfluous and detrimental in allowing the absorption of impurities which must be subsequently removed by refining. The electric furnace provides a neutral melting chamber with no possibility of gases from combustion being introduced. The authors believe that a direct-arc furnace with a non-conducting hearth, such as the Heroult steel furnace would be the most practicable. It is probable that the power consumption would not be over 300 kw.-hr. per ton of copper melted. Using this figure and basing other expenses on electric-furnace steel practice, the cost of melting cathode copper in a furnace of 25 tons capacity per charge should not exceed \$4.75 per ton, or 0.238 cents per pound, of copper melted, with power at $\frac{1}{2}$ cent per kw.-hr.

If iron were non-magnetic, by some freak of nature, without otherwise losing its mechanical properties, our modern civilization would collapse. The possibilities have recently been stated by Prof. J. A. Fleming. Crowds would go as usual to their railway stations, metropolitans, tubes and main lines, only to discover that no electric trains are running. The dynamos at the supply stations have all ceased to act. Officials are frantically endeavoring to find out why the current is cut off, but all telephones and telegraphs are dead. No electric light can be obtained, no electric bells; no taxi cabs or motor buses can move because their magnetos for the same reason are perfectly useless. No main line trains can run because all signals are unworkable. No anarchist in his wildest dreams could imagine a more complete knockout blow dealt to our civilization than would thus be effected. Darkness, starvation and unemployment would in one month reign in all great cities and all shipping would be sealed up in port or lost on the high seas because the compasses had ceased to direct. Factories would be idle and electric power supply cut off at the source. All business would be arrested.

ELECTRICAL SAFETY RULES.

The U. S. Bureau of Standards in Circular No. 49 has published a set of safety rules to be observed in the operation and maintenance of electrical equipment and lines. The pamphlet is divided into three parts. The first two parts consist of general rules which apply to the employer and to the employe respectively, and the third part comprises, under separate headings, those special rules which apply particularly to employes engaged in special classes of electrical work.

The section for employers calls for providing employes with rules, diagrams and emergency instructions, their assignment to work, according to their demonstrated abilities, and the division of responsibility among them in a definite manner so that danger may not arise through conflict on points of authority. The employer is also required to supply portable safeguards, to enforce general operating precautions and to supply employes with forms for the adequate reporting of accidents. The final requirement is that the rules for employes be strictly enforced.

Rules for employes in general are subdivided into six groups. The first enumerates those general precautions the necessity for which seems obvious but the non-compliance with which is nevertheless responsible for many injuries. The second presents general operating rules, defining the duties and relations of those employes who direct others and the operating methods by which safety is required. The third group prescribes the precautions for handling live parts under varying conditions of voltage and location. The fourth and fifth deal with the procedures for assuring the continued safety of work about normally live or moving parts respectively by avoiding all possible sources of misunderstanding in killing parts. The sixth group covers in some detail the procedure for making protective grounds and short circuits.

Special rules for employes comprise nine separate headings, covering the special hazards of work about electrical equipment in stations, at switchboards, about overhead lines, in arc lamp attendance, on underground lines, meter setting, testing, and in tunnel or mine work. Each class of worker is directed to familiarize himself also with the preceding general rules which apply to all classes of electrical employment.

Power Station Operation.

Do not allow oil cans, tools, and wiping cloths to catch in moving parts of machinery. In passing any machine in operation be careful not to touch it or to allow tools or other pieces of metal to touch the machine or its connections. Do not use iron or tin oil cans near field magnets. Use only oilers and wipers with insulated handles on commutators, switches, and other electrical equipment.

Avoid loose clothing about moving parts of machinery and shoes that slip easily on the floors about live or moving parts.

Do not work on or near exposed live parts unless authorized to do so, and then strictly observe the general rules for handling live equipment and wires.

In handling fuses or switches use only the insulating handles or the special rods or tongs provided. Never replace or remove link fuses from live terminals, nor remove or replace brushes on live equipment. In handling voltage transformer fuses use the insulating

rods or tongs and stand on the insulating platforms or mats provided.

Do not work on any normally live part or moving part in assurance that it is not alive or will not move, unless you have first protected yourself against danger by having the live or moving part killed.

Before doing any work other than regular station operation about exposed live or moving parts secure special authorization from the chief operator.

Do not smoke or bring open-flame devices into storage battery rooms.

When working where your eyes may be injured by arcing or by flying particles, wear non-inflammable goggles.

When working in an elevated position, keep tools and materials not in use in proper receptacles, and do not drop tools or materials. Do not work above live or moving parts unless necessary. Assure yourself of the security of your position and support before proceeding with work.

Promptly report any broken or unsafe tools, defective safety appliances, or apparatus, or any dangerous condition of equipment or surroundings to your superiors.

Switchboard Operation.

In handling instrument circuits, never open the secondary of a current transformer.

Do not work on or near exposed live parts unless authorized to do so. When working near fuses and circuit breakers, be careful to avoid injury from their operation. If the hands are exposed to flashes, wear insulating gloves. When working on one section of a switchboard or in one compartment, mark it conspicuously, and place barriers to prevent accidental contact with other sections or entrance into other compartments.

Do not work on any normally live or moving part in assurance that it is not alive or will not move unless fully informed on the general precautions to be used.

Do not open manual cutouts which are not designed for opening loaded circuits, unless the circuit has first been opened at a proper cutout. When operating manual cutouts, keep the body as distant and as far below as possible and use only one hand. In handling fuses or switches use only the insulating handles or the special rods or tongs provided. In handling voltage transformer fuses always stand on insulating mat or platform. Never replace or remove link fuses from live terminals. When cable plug connectors are used, do not allow one end to remain loose while the other is connected to a live terminal.

Do not report lines or equipment dead for other men to work on until the lines or equipment have been cut out by air break manual cutouts, protective grounds have been applied to the parts so cut off, and "Men at work" tags have been attached to the cutouts. Also, in reporting, identify the parts by position, letter, or number, as well as by description.

Report to the chief operator any unusual conditions of load, the opening of any automatic cutout, and the indication of any ground on a normally ungrounded outgoing circuit.

Do not again close circuits above 750 volts, which have automatically opened immediately after each of

three consecutive closings within ten (10) minutes, without special instructions from the chief operator. Do not again close any circuit opened by automatic cut-outs if persons are known to be working on the circuit.

All metal parts of equipment on switchboards shall be handled as if operating at the highest voltage to which any portion of the equipment on the same switchboard panel is subject, unless the parts are known by test or otherwise to be free from such voltage.

When an accidental ground is indicated on a normally ungrounded circuit, immediately open the circuit. If upon a trial closing, you find that the accidental ground still exists, open again, and do not again close without special instructions by the chief operator.

When working in an elevated position, keep tools and materials not in use in proper receptacles, and do not drop tools or materials. Do not work above live or moving parts unless necessary. Always assure yourself of the security of your position and support.

Promptly report to your foreman any dangerous condition of equipment, lines, or surroundings, including defective tools, switches, brushes, or protective devices, or live cases of apparatus.

Overhead Line Operation.

Linemen and assistants, and groundmen, in construction, extension, removal, and repair work, shall study and strictly observe the following rules, as well as all the general rules of Part II.

Before climbing poles, ladders, scaffolds, or other elevated structures, first assure yourself that the pole, ladder, scaffold, tree, cross-arm, boatswain's chair, or other elevated support is strong enough to safely sustain your weight and that of the work to be done.

Poles must be tested for decay near the ground line with a bar, screw driver, or other tool, and must be sounded for decay at the center by rapping with a heavy tool or block of wood.

When poles or cross-arms are apparently unsafe from decay or unequal strains of wires on them, they must be properly braced or guyed before climbing.

Where poles are stepped, make use of such steps in climbing.

Do not support yourselves by pins, brackets, cross-arm braces, or wires.

Do not work on or about overhead lines until authorization has been given by the chief operator and he has stated whether the section to be worked on is dead or alive, and that the circuit is tagged at the proper points to show that it is being worked on. In all such statements identify the lines on or about which work is to be done by position, letter, or number as well as by description. Do not go among any wires until you know their voltage.

Leaning over and crowding through wires must be avoided. Place yourself so that you will not fall on wires should an accident occur. Handle switches and fuses only by means of the special insulating handles, rods, or tongs provided.

When on poles support yourself with both hands, unless you are secured in position by an approved safety belt or other adequate means.

Never open a series circuit; always connect a jumper across any arc lamp or loop in such a circuit before working on it.

Do not depend on the insulation of wires, and treat all lines as alive unless they have been killed. Treat as alive all lines (unless thoroughly grounded) which are being strung near power lines; regard them as being of the same potential as the power lines.

When working on live equipment or lines, never allow any part of the body to come in contact with any other live or grounded part, other than that worked on. While touching power lines or equipment, avoid touching ground wires, guy wires, span wires, metal pipes, metal sheaths, signal lines or equipment, metal fixtures on poles, or metal poles. While touching signal lines or equipment, metal sheaths, metal pipes, ground wires, or metal fixtures on poles, avoid touching power lines or equipment, guy or span wires.

When working overhead, keep tools and materials not in use in proper receptacles; do not throw tools or materials to the ground, but lower them. When working overhead, or hoisting or lowering materials above spaces where traffic occurs, you must have a man stationed to warn passers-by. Workmen must not stand where they can be struck by materials dropped by men working overhead.

Never string lines above live lines operating at over 7500 volts. Never change the strains on a pole by adding or removing lines, unless you have assured yourself that the pole is equal to the altered strains.

Report promptly to the chief operator any dangerous condition observed such as defective insulators, pins, cross arms, sagging wires, etc.

When you find crossed or fallen wires, remain on guard and have the chief operator notified. Only when authorized by him, may you correct the condition.

In applying a grounding device, attach it first to the ground connection, and then to the parts which are to be grounded. In removing such a device, it must be removed from the ground connection last.

Underground Operation.

All cable splicers and other workmen in underground construction or operation must study and strictly observe the following rules in addition to the general rules of Part II:

Before opening manholes where traffic may be obstructed, have the fire department notified.

Do not enter manholes until you have assured yourself that the manholes are free from dangerous gases, by testing with approved safety lamps, by ventilation, or by other adequate method.

When removing manhole covers in places where traffic occurs, promptly surround the opening with a barrier guard, and display danger signals or red lights from two sides of the barrier at right angles to the direction of traffic.

Do not enter manholes unless a man is stationed at the surface. Do not leave manholes unwatched until the manhole covers have been replaced and fastened in position.

Do not smoke or use open flames, matches, or torches in or near manholes. Approved safety lanterns only may be used. Avoid sparks in handling

live parts or cable sheaths and avoid igniting soldering flux in soldering and wiping joints.

Do not begin work about lines until you have received authorization from the chief operator and his statement whether the lines are alive or dead; and have identified the lines to be worked on by position, number, or letter, as well as by description. If lines and cables are not properly identified by markings, you must not work upon them. Always test cables with the test devices provided, before piercing the cable sheaths.

Do not splice live cables operating above 750 volts.

Promptly report any dangerous condition to the chief operator, whether observed in underground or overhead construction. Particularly report insanitary condition, gas or missing cable tags in manholes, and sagging wires or broken supports in overhead construction.

When you find crossed or fallen wires in overhead construction or gas leakage from manhole cover, remain on guard and have the chief operator notified without delay. Only when authorized by him may you correct the condition.

Meter Operation.

Never leave joints or loose ends of wires untaped.

Do not open the secondary circuit of a current transformer, but short-circuit it, before changing connections.

Do not use bare fingers or hands to determine whether the circuit is alive. Never remove or replace fuses in live circuits except with approved appliances.

Do not open circuits at meter connections, until the circuits have been first properly opened at manual cutouts.

Use only the special hand tools provided, and so reduce the danger of short circuits.

When working where the eyes may be injured by arcing, wear non-inflammable goggles with suitable glasses.

Promptly report to your foreman any live meter case, or any condition of a meter, of its connections, or of overhead lines, which might endanger life and property.

When you find crossed or fallen wires remain on guard and have the chief operator notified without delay.

The metal output of California for 1913, according to Charles G. Yale, of the United States Geological Survey, was \$26,812,489, an increase of \$428,543 over the 1912 production. All the metals except zinc showed an increased yield, although the ore treated was less in quantity and there were fewer mines reporting a production than in 1912. The silver amounted to 1,378,399 fine ounces, valued at \$832,553, an increase of 78,263 fine ounces in quantity and of \$32,962 in value. The recoverable copper was 34,575,007 pounds, valued at \$5,359,126, an increase of 1,123,335 pounds in quantity but a decrease of \$160,400 in value. The decreased value was due to the lower price of copper in 1913. The recoverable lead output amounted to 3,514,342 pounds, valued at \$154,631, an increase of 2,369,611 pounds in quantity and of \$103,119 in value. Only two counties reported any production of zinc.

BUREAU OF MINES' P. P. I. E. EXHIBIT.

The United States Bureau of Mines is planning a comprehensive exhibit at the Panama-Pacific Exposition at San Francisco in 1915. In arranging the exhibit, the bureau has had in mind, not only the value of interesting those engaged in the various mining and metallurgical industries, but also the education of the general public to a better knowledge of the magnitude of these industries and to the efforts which are honestly being made by the miners and mine operators, with the assistance of the Bureau of Mines, looking toward a more safe conduct of mining and a more efficient utilization of the products of the mines after they are won from the earth.

The bureau's exhibit is in the Palace of Mines and Metallurgy. An automatic duplex projecting machine will continuously show lantern slides illustrative of the activities of the bureau and simultaneously give descriptions of the lantern slides. Nearly will be shown the layout of a model hospital, including a receiving room, ward room and operating room, fully equipped for demonstrations by the United States Marine Hospital Service; also a model of a change and wash house, another welfare feature which is being installed at modern mining and metallurgical operations. A plan of an ideal mining town will be shown.

First-aid demonstrations will be given frequently. An air of reality will be lent to the demonstration by the removal of apparently injured men from the exhibition mine beneath the building by helmet and rescue crews.

A complete display of rescue apparatus and safety lamps will be given in a glass smoke-room. Tests of safety lamps will be made, showing their tendency, under favorable conditions, to ignite explosive gas, and also showing methods of testing for explosive gas by means of their caps. An exhibit of the physical and chemical characteristics and constituents of explosives is being arranged.

Visitors going through the exhibition mine will regain the surface through the radium booth in which actual radium emanations will be shown. Surrounding this radium booth, there will be complete exhibits of the various ores and of radium products. The metallurgy of various products will be shown by a comprehensive exhibit.

The opportunity for increased efficiency in the use of fuels will be demonstrated by a device showing the proportionate amounts of fuels which go to make up the various losses incident to consumption in comparison with that which ultimately goes to useful purposes. Typical analysis of coal from the various fields will be shown by models and samples, as will also the yield of coke and by-products obtained by various coking processes. It is expected to show smoke-preventing and smoke-producing methods of stoking by means of an ingenious motion-picture device.

The steel belt is the most efficient of all forms of power transmission by rope or belt drive, but is so stiff and inelastic that the connection is too rigid for any installation caring for many load variations, such as an electric motor. A long, elastic leather belt has been found to give the softest transmission.

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Speculation, both mental and financial, is rife as to the ultimate effect of the European war upon the electrical industry. The war has already demonstrated the dependence, or rather the interdependence, upon European sources of many industries for at least a part of their raw materials. Prices have gone up in anticipation of a curtailment of supply and manufacturers are already seeking new possible sources.

Franklin K. Lane, Secretary of the Interior, foresaw the effect as clearly as anyone when he stated, "A direct benefit of the European war to the United States will be its effect in making the people of this country realize to a greater extent the value of its mineral resources." The enforced development of many of these neglected materials will not only render this country independent of all others but actually enable it to export much of what it has formerly imported.

The chief factor in this manufacturing development will be electricity, as can be easily proved by analyzing the materials which Secretary Lane has listed in a recent interview.

First among these are the mineral fertilizers, nitrogen and phosphorus. Electricity has made possible the utilization of atmospheric nitrogen for both fertilizer and gunpowder. Twelve factories with an annual capacity of nearly two hundred thousand tons of calcium cyanamide are situated in the war zone. The cutting off of this supply, the inevitable exhaustion of the saltpeter beds of Chili, and the possibility of favorable Federal terms for the development of cheap hydroelectric power should make this an enticing field for the investor. Germany has doubled her crops of cereals and potatoes by using from 50 to 100 pounds of lime nitrogen per acre, representing an annual consumption of over five pounds per capita. Less than half a pound is now required in the United States, but the future consumption will undoubtedly be greater.

Phosphoric acid can be produced more cheaply by means of the electric furnace than by the older sulphuric-acid process. The phosphate lands of the South and the West are soon to be released for development and will afford another great consumer of electric energy.

In the steel industry electrolytically-refined manganese can be made to replace the supply now cut off from Russia, artificial graphite, a product of the electric furnace, is as good as the natural product from Ceylon and steel from the electrical furnace is now supplanting the more costly crucible steel. The electric furnace is also being used to produce the ferro-alloys for hardening steel, most of which until recently have been imported from England and Germany.

The electric smelting of zinc, also, is now making possible the treatment of low grade ores formerly unable to compete with the product from Belgian, Prussian, Polish and Austrian smelters which are in the troubled territory.

These remarks are not intended to convey the impression that it is the wish of the people of the United States to in any way profit from the misfortunes on Europe. The assets of the world, not only

in money, but in culture, science and progress are being destroyed every day that the war continues and every citizen of the world must sustain his proportion of the loss. The only possibility of ultimate gain lies in the likelihood that the horrors and costs of the war will lead to a final realization of the barbarism of this method of settling differences.

But now that many of our raw materials, particularly those of a chemical nature, are no longer available from Europe, America is forced to supply the deficiency and incidentally to grasp this industrial opportunity.

All of these beneficent utilizations, however, are predicated upon the maintenance of that dignified policy of absolute neutrality advocated by President Wilson. Neither the acid of personal bias nor the base desire for gain should be in excess in the salt of friendship for each of the striving nations. An indicator far more delicate than litmus is ever-present in the reaction of public opinion and the analysts realize that a prosperous outcome to this nation is dependent upon the continuance of neutrality.

The high character of the California Railroad Commission is shown not only by its strict adherence to what it believes to be right but by its frankness in admitting when it is wrong. At a time when there was some question as to the proper relationship that should exist between the public and the public utility corporation the Commission suggested that the old-English doctrine of principal and agent was applicable. When this plausible theory was followed to its logical conclusion it was found to be impracticable and unjust in its application to both the server and the served:

The fallacy in this theory of service relationship was demonstrated in these columns last April by Mr. H. S. Cooper. It was subsequently shown that the principal invariably takes the initiative and directs the action of the agent. In the case of electric railway, telephone, light and power companies improvements have usually been initiated by the companies, and consequently this theory cannot always be made to apply in practice.

Recently Commissioner Eshleman, president of the Commission, in the course of the Antioch rate decision "rejects Mr. Thelen's doctrine of agency." He states that "the authorities cited do not at all convince me that the Supreme Court will ever hold, when the matter is directly before it, that the owners of public utility property hold such property as an agent at all. In fact that court has in several well-considered cases definitely decided that such is not its view."

The remaining tenable theory is that of partnership. It is firmly believed that this theory will better conduce to the mutual benefit of both parties. The corporations are willing and anxious to co-operate with the public as partners, both participating in the profits. A ruling along these lines would do much to establish confidence and encourage development.

The Antioch rate decision propounds another theory which if followed to its logical conclusion leads to a startling result. The claim of the utility that rates should be estimated upon the "cost to reproduce

new" is not allowed and preference is expressed for "the original cost" as the proper rate-making basis.

Conceding that it is possible to ascertain the amount of money which the utility has wisely and honestly invested, assume the case of two hydroelectric companies serving the same city, one a pioneer whose very mistakes were wisely and honestly made, the other a newcomer profiting from the experience of its predecessor. Other things being equal the newcomer should be able to show the smaller investment, its cost of service would be less and its rates would consequently be lower.

In accordance with this theory every economy practiced and every efficient plan to reduce the cost of service would be met by a corresponding reduction in rate.

The inference can be drawn that any such artificial effort to regulate competition will inevitably result in the survival of the fittest. The theory upon which it is based, while appropriate for some cases, should not be universally applied, for there is danger of the commission thus defeating one of the prime purposes of its existence.

Street railway systems occupy a peculiar position among utilities in that they thrive in a permitted atmosphere of discrimination. With other utilities the flat rate system of charging is fast falling into disrepute, as it results in abuse of the privilege and discriminates against the small user.

The reason for sparsely settled cities of high development and maintenance costs is not deeply hidden. With time, the elimination of the flat rate system of street car fares would tend toward lower city taxes.

The object of the flat rate fare in building up the outlying residence districts is advantageous only to the owners of real estate remote from city centers and to those who from choice or necessity live further out.

The loss from this class of business must be borne by the profitable short distance passenger in the business district. This is palpably not in accord with the fundamental principles on which the findings of public service commissions are based.

Unlike telephone service, transportation costs less with density of population. The excess cost of each mile zone served from the center of any city may therefore readily be conceived.

The zonal fare system or measured service of European countries offers the most satisfactory solution to this problem of making just charges for this service. Among other advantages of this service would be an improvement in the transfer system and partial elimination of its abuse.

The statement has often been made that street railway fares are lower on this side the water, but the official English figures show that the average fare is 2.1 cents as against five cents in this country. In Scotland it is stated to be 1.9 cents. There may be reasons which would modify this difference, but there is no doubt but that a reduction would be effected if this system were adopted, and to the advantage of downtown traffic. Both the company and the passenger would profit by a reduction in short distance fares.

Service Partnership Relations

Metering Travel

PERSONALS

J. Gibson has been appointed manager of the B. C. Telephone Company at Greenwood, B. C.

S. A. James, representing the Olston Electric Stove Company, is visiting the Pacific Northwest.

F. N. Cooley, supply specialist, Western Electric Company, was at Portland, Ore., during the past week.

R. D. Holabird, president of the Holabird, Reynolds Electric Company of San Francisco, is at Lake Tahoe.

H. C. Goldrick, Pacific Coast sales manager of the Kellogg Switchboard & Supply Company is at Los Angeles.

J. F. Ryan, manager Portland, Ore., office Western Electric Company, visited Seattle, Wash., during the past week.

C. W. Yerger, representative of H. B. Squires Company at Los Angeles, has returned from a visit to San Francisco.

Elgin Stoddard, vice-president and general manager of Charles C. Moore Company, engineers, has returned from a business trip through the Southwest.

R. H. Kennedy, representing the American Electric Heater Company, called on the Portland, Ore., trade last week.

Howard Harris, secretary of the Fowler Telephone Company, has returned to Fowler, Cal., from a visit to San Francisco.

L. F. Youdall, manager of the Electric Machine & Equipment Company of Stockton, was at San Francisco during the past week.

L. F. Mershon, secretary of the Turlock Home Telephone & Telegraph Company at Turlock, Cal., visited San Francisco during the past week.

G. C. Harris, president of the Tulare Home Telephone Company, has returned to Tulare, Cal., from a trip through the Pacific Northwest.

A. J. Myers, Pacific Coast manager for the Wagner Electric Manufacturing Company, has returned to San Francisco from Los Angeles.

H. R. Noack, president of Pierson, Roeding & Company, is again at his desk in San Francisco after a successful fishing trip in the Sierras.

H. N. Lauritzen, Pacific Coast manager Holophane Works of General Electric Company, is confined to his home in San Francisco by illness.

Miles Bronson, general superintendent of the New York Central & New Haven (electrical divisions), is visiting cities in the Pacific Northwest.

C. C. Hillis, treasurer and general manager of the Electric Appliance Company, San Francisco, is planning to leave for the East on September 4th.

N. K. Cooper, salesman with the San Francisco office of the Westinghouse Electric & Manufacturing Company, is hunting big game in the vicinity of Mt. Lassen.

J. Q. Brown, formerly chief engineer for the San Francisco & Oakland Terminal Railway Company, is manager for a new electric power company at Rochester, Nevada.

A. V. Olsen, salesman with the Electric Railway & Manufacturers' Supply Company has returned to San Francisco from Chicago, where he was called by the death of his father.

F. G. MacGougan, commercial superintendent of the British Columbia Telephone Company, has returned to Vancouver, B. C., from an inspection trip through the Kootenay district.

T. E. Bibbins, local manager of the General Electric Company, is making an automobile trip through northern Cali-

fornia with E. O. Shreve and John Hood of the San Francisco office.

P. B. Wilson, district agent at Madera for the San Joaquin Light & Power Corporation, was a recent visitor in San Francisco, enroute from Portland, where he has been spending a vacation period.

Orman Higman, chief electrical inspector of the Dominion of Canada, visited Canadian Pacific Coast cities during the past week, on a tour of inspection of the various government laboratories in the West.

E. R. Weeks Jr., an electrical engineer of Spokane, Wash., was travelling in Belgium at the outbreak of war in Europe. He succeeded in making his way to Brussels and was ultimately able to reach home.

P. Loyd Lewis, manager of the Wagner Electric Manufacturing Company at Kansas City, has been investigating the business situation on the Coast, with special reference to opening a branch office at Los Angeles.

H. L. Blackstone, formerly travelling freight agent for the Western Pacific Company, has been appointed general agent for the Northern Electric Railway Company, with headquarters at the company's new office at 332 Pine street, San Francisco.

H. K. Dutcher, consulting electrical and hydraulic engineer, has just returned to Vancouver, B. C., from an Eastern trip made in connection with the two million dollar hydro-electric development project for the city of Calgary, Alta., on the Elbow River.

Raymond Akerman, special representative of the Capital Electric Company of Salt Lake City is making a tour of the Eastern cities, visiting the factories and sales offices of many of the companies which his company represents in the inter-mountain district.

C. H. Fletcher, chief electrician of the city of Vancouver, B. C., was tendered a vote of thanks by the mayor and council of the city for the very creditable performance of transferring the police patrol system from one building to another without the loss of a call.

David B. Steinman, on a year's leave of absence from the engineering department of the University of Idaho, Moscow, Idaho, is now at New York with the Lindenthal Company, having decided to resign from the university staff. Dr. Steinman left Moscow during the early part of June.

H. J. Adams, student at the University of Idaho, Moscow; **L. W. Blymer**, electrician in charge Lincoln & Clunie Electrical Advertising Company, Mills Building, San Francisco; **C. A. Cannon**, operator, Pacific Power & Light Company, Bodfish, Cal., and **M. F. Fenton**, San Diego, Cal., have been elected associate members of the American Institute of Electrical Engineers.

J. J. Lampert has been placed in charge of the newly equipped shop for charging electrical devices which has just been put into commission by the Chanslor & Lyon Company at Seattle. The care of storage batteries has become more important than ever now that so many cars, both low and high priced, are equipped with electric lighting and self-starting systems.

Axel Nielsen has returned from Denmark to resume his duties at Stanford University. **J. W. Davis**, who acted as Mr. Nielsen's substitute during the past year, is now with the electrical department of the University of Illinois. Mr. Nielsen is giving particular attention to electrical analysis, and is in charge of standardizing and theoretical investigations in the electrical laboratory of the University.

F. B. Uhrig, western district manager for the Western Electric Company, is at Salt Lake City on a regular tour of inspection. Mr. Uhrig states that so far he has not been able to discern any marked effect of the war on the business of his company in this territory. Few large enterprises were in progress at its beginning and the bumper crops being

obtained throughout the entire West have tended to sustain the demand for the smaller detail and supply material. He reports a healthy co-operation between the central stations, jobbers, dealers and contractors throughout practically his entire territory.

Harris J. Ryan, professor of electrical engineering at Stanford University, recently returned to the University from La Jolla. He reports that in addition to improvements in the sustained high frequency, high voltage generator which he has been experimenting with during the past year, three transformers have been installed in series to give 165 kilovolts. A main condenser with 350 kilovolt insulation has also been installed for the promulgation of shock, and for tests on high frequency flash-over and standing waves. A 350 kilovolt, 60 cycle transformer has recently been ordered, and will be connected to the present transformers so as to give a maximum r.m.s. voltage of 515 kilovolts with one terminal grounded. Professor Ryan's high voltage laboratory is rapidly being equipped to provide a source of every recognized form of electrical action for instruction and investigation.



George Kidd, the newly appointed manager of the B. C. Electric Railway Company, Ltd., at Vancouver, B. C., entered the service of this company in January, 1908. He was secretary of the London office until March, 1911, when he left for Vancouver to be comptroller and assistant to the general manager. This position he occupied until May 6, 1914, when on account of Mr. Sperling's departure for England on company business, he

was appointed general manager. His late appointment, already referred to in these columns, has met with general favor and his regime has commenced with several acts which will make for a close bond between the company and the public, and the employees. Mr. Kidd was responsible for a donation by the company of \$1000 for the city of Vancouver Patriotic Fund, and for an arrangement whereby men in uniform are transported free of charge over some parts of the company's system, and on parts where this was found to be impracticable, for a grant to them of \$500 for car tickets.

OBITUARY.

H. A. Tedford, engineer in charge of the southern district of the Northern California Power Company died at Willows, Cal., on August 24, 1914, following an operation for cancer. Mr. Tedford was the oldest and most beloved employe of the company, having been in active service since the first operations in 1901. He had direct supervision over the construction of the Kilarc, Volta and Inskip power plants and held other positions of responsibility which proved his high character and great ability. He is survived by his widow and two children who reside in the town of Willows. His death is the source of great sorrow to all who came in contact with him and who agree that this world is better for his having lived in it.

ELECTRICAL MEN ENJOY MOVIES.

On Tuesday last a representative gathering of San Francisco electrical men attended a moving picture exhibition at the Palace Theater, where two films prepared by the Society for Electrical Development were exhibited. The invitation was extended through the courtesy of the theatre management and the American Motion Picture Company in appreciation of the courtesy shown the latter concern by various electrical manufacturers whose co-operation in the loan of various materials and products is gratefully acknowledged.

MAZDA PUBLICITY BUREAU.

Pacific Coast offices of the Mazda Publicity Bureau have just been opened in the Rialto Building, San Francisco, by H. H. Cudmore, director.

The Mazda Publicity Bureau of General Electric Company is a new organization, general in scope, planned to assist in stimulating the sales of Mazda lamps, irrespective of brand. This is to be accomplished by an intensive, localized campaign of maintaining and extending the good will in the trade mark "Mazda."

Mr. Cudmore needs no introduction to the electrical men of the Pacific Coast. First as manager of the Brilliant Electric Co. of Cleveland, then as adjuster for the lamp com-



H. H. Cudmore, Director Mazda Service Bureau.

panies, and recently as special representative for the Society of Electrical Development, his pleasing personality and action-getting ability have endeared him to the entire industry. He will be assisted in his work as director by A. B. Bond, central station stimulator, Clark Baker, agents' stimulator and F. J. Blaschke, in charge of publicity and exhibits.

This organization plans to teach the trade and the consumer in a commercial manner that "Mazda means something?" By means of bill-boards, street cars, window cards and other forms of effective publicity they will demonstrate the aid of Mazda service. They will tell of the research work, the laboratory tests, the manufacturing care and the sales service that benefit the Mazda consumer. This is to be accomplished by sectionalized personal work in each Pacific Coast community. Their purpose is to educate the public that Mazda stands for quality, quality being to a lamp what character is to a man. By this means Mazda is to be made the "buy-word" of satisfactory lamp service.

PACIFIC COAST A. I. E. E. CONVENTION.

Members of the American Institute of Electrical Engineers are cordially invited to attend the Pacific Coast Convention of the American Institute of Electrical Engineers to be held in conjunction with the Northwest Electric Light & Power Association, at the Davenport Hotel, Spokane, Washington, September 9-11, inclusive, 1914.

An excellent program is being arranged which will include technical papers and discussions dealing with western subjects or written by Western engineers. Excursions to the power plants of the Washington Water Power Company and of the Inland Empire Railway, one of the most extensive single-phase railways in the world, will be made. In addition to excursions there will be various forms of amusement and entertainment provided for the members, including entertainment especially for the ladies who may accompany members.

A rejuvenation of the Jovian Order will be held on Saturday evening, September 12th, in the Knights of Pythias Temple, the entire building having been rented for the occasion. I. A. Shorne is in charge of all arrangements and has made provision for a colored quartette, colored soloists, colored string quartette and soloists of international fame.

Following the rejuvenation a southern style banquet is planned, with colored waiters in proper southern dress. All food for the banquet to be cooked by electricity.

H. B. Haggemiller is in charge of the degree work and is having frequent rehearsals so that a complete rendition of the ritual can be given. The floor work is in charge of E. J. Simons. To assist him in his work he has decided to select his imps from visiting delegates.

H. L. Bleecker will be toastmaster at the banquet.

The degree team will consist of L. F. Austin, Jupiter; H. K. Stacy, Neptune; C. F. Uhden, Vulcan; H. L. Bargion, Pluto; M. Sebern, Mars; J. A. Gorman, Apollo; C. L. Bankson, Hercules; L. N. Rice, Avrenim; H. G. Peirce, Mercury.

The usual arrangements for transportation have been made. Members from California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming and British Columbia should purchase a first-class full fare one-way ticket to Spokane, and secure from the ticket agent a Standard Convention Certificate. When this certificate has been signed by the secretary of the convention the return ticket may be obtained at one-third single fare. Tickets for the return journey will be issued by the same route only as used on the going journey, and will be good for continuous passage only.

Following is the list of papers to be presented at the Institute Meeting:

"A Distribution System for Power Purposes," by F. D. Nims, Vancouver.

"Electrical Application in the Lumber Industries," by E. F. Whitney, Portland.

"Operation of the Butte-Anaconda and Pacific, 2400 V. D.C. Railway," by J. B. Cox, C. A. Lemmon, Schenectady.

"Considerations in the Application and Control of Electric Motors for Gold Dredges," by G. B. Rosenblatt, Salt Lake City.

"The Effect of Delta and Star Connections Upon Transformer Wave Forms," by Prof. Leslie F. Curtis, Seattle.

"Economy in the Operation of 55,000 Volt Insulators," by M. T. Crawford, Seattle.

"Electric Transmission at 150,000 Volts for Pacific Light & Power Corporation," By E. Woodbury, Los Angeles.

Report of Work Done by Joint Committee on Inductive Interference With Telephone Lines, by A. B. Babcock, San Francisco.

The papers prepared for the association meeting include the following:

"Rates and Physical Valuation of Public Utilities," by W. W. Cotton.

"Outdoor Substations" by J. C. Martin.

"Electric Power Development on the Pacific Coast," by W. E. Herring.

"Organization and Operations of Branch Offices and Plants," by L. A. McAuthor.

"Extension of Electric Service," by M. C. Osborn, with supplement by James E. Davidson.

The other details, including those for entertainment, were published in this journal of August 1, 1914.

PACIFIC COAST GAS ASSOCIATION CONVENTION.

The 22d annual convention of the Pacific Coast Gas Association will convene at Long Beach, Cal., on September 15, 16, 17 and 18, 1914, and will be presided over by Mr. Champ S. Vance of Los Angeles, California.

The address of welcome to the members of the association will be delivered by Hon. L. N. Whealton, mayor of the city of Long Beach, and Mr. P. E. Hatch, president of the Long Beach Consolidated Gas Company, will welcome the members on behalf of that company.

The following papers are announced:

President's Address Champ S. Vance

1. General Utilization of Gas: By Gas Exhibit Committee.
 - a—Gas Street Lighting C. B. Babcock
 - b—Gas Lighting in the Home..... R. J. Thompson
 - c—Domestic Use of Gas..... B. S. Pedersen
 - d—Industrial Uses for Gas..... H. P. Pitts
 - e—Water Heating by Gas..... H. R. Basford

2. The Nature and Extent of the Obligations of a Gas Company to Improve Its Facilities and Extend Its Service C. P. Cutten

3. The Appliance End of the Gas Business..... P. C. Wickersham

4. Welding in Gas Distribution..... D. E. Keppelmann

5. Wholesale Distribution and Measurement of Gas....

..... John D. Hackstaff

6. Problems of Pressure Reduction and Regulation....

..... A. W. Cash

7. "Safety First"..... C. A. Luckenbach

8. Gas Versus Electricity for Cooking..... R. C. Powell

9. Wrinkles H. W. Burkhardt

10. Experiences John Clements

The Hotel Virginia will be the headquarters of the Association, at which the meeting, the Appliance display, and banquet will be held. The management of the hotel is also arranging the following entertainment for the members and their families. Tuesday, September 15th, 5 p. m.—Surf bathing party. Wednesday, September 16th, from 4 to 6 p. m.—Reception and tea to the visiting ladies; and Wednesday night will turn over to the association the ball room from 9 p. m. to 12 m. They have also advised that the courtesies of the golf course, as well as the tennis court, will be thrown open to the members of the association. On Thursday night, September 17th, a theatre party will be given to the visiting ladies.

A banquet will be held in the Hotel Virginia on Thursday evening, September 17th, at 7:30 o'clock p. m. The price of the banquet will be \$5 per plate and for which tickets can be obtained from the secretary during meeting.

Plans are being made for an outing for the members and their families on Friday, September 18th, full information covering which will be furnished members in due time. The convention will be called to order promptly at 10 o'clock a. m. on Tuesday, September 15th, at meeting hall in the Hotel Virginia.

NEW CATALOGUES.

Benjamin Fixtures for Gas Filled Mazda Lamps are illustrated and described in a pamphlet just issued by the Benjamin Electric Manufacturing Company.

Titan Storage Batteries are beautifully illustrated in colors and clearly described in text in an attractive booklet from the Titan Storage Battery Company of Newark, N. J.

TRADE NOTES.

E. S. Knight & Company of Portland, Oregon, have obtained the electrical contract for the new Masonic Hall in Silverton, Oregon.

The Power Equipment Company has opened offices in the Boston Building, Seattle, in charge of Grover McHugn as local manager.

The Electrical Engineering Company of Seattle, Wash., is equipping the new St. Elizabeth Hospital at Baker, Oregon, with a complete electrical layout.

The Beaver Electric Company of Portland has the contract for the electrical installation in the apartment house owned by H. O. Triplett on the north side of Harrison street, between Eleventh and Twelfth streets.

The Pacific Fire Extinguisher Company of Portland, Oregon, has obtained the electrical contract for wiring the two new stations of the Pacific Telephone & Telegraph Company at Michigan and Killingsworth avenues, Portland, Oregon.

The Salt Lake office of the General Electric Company has recently taken an order from the Utah Copper Company for 188 compensators being used in starting the induction motors used in the flotation process which that company is now using for the treatment of a part of its ores.

Geo. J. Henry has returned from the Great Western Power Company's plant at Las Plumas, Cal., where his design for a high pressure oil pumping system is supplying the step bearing and the governors on the new 18,500 h.p. turbine installation recently completed and now in operation. The oil pumping system adopted at this plant is similar to that employed in the Sierra & San Francisco Power Company's four 8500 kw. units supplying the United Railroads and also designed by Mr. Henry. In connection with this latter installation it is interesting to note that this method of oil pressure supply has operated the governors at this plant for five years without changing the oil. Mr. Henry also reports considerable activity in mining in Plumas county and the delivery of a large high pressure lap-welded pipe line for the U. S. Government to Manila for the Camp John Hay installation during the last month. Also the six foot lap-welded pipe for the large turbine installed at Las Plumas.

The Westinghouse Electric & Manufacturing Company reports the receipt of the following orders for mine apparatus:

Yukon Gold Company, Iditarod, Alaska: Six 125 k.v.a. oil-insulated, self-cooled transformers.

Anaconda Copper Mining Company, for Lochray Coal Department, Great Falls, Mont.: One 75 kw. motor generator set and switchboard.

United Verde Copper Company, Jerome, Ariz.: Three 300 k.v.a. and three 30 k.v.a., oil insulated, self cooled transformers for a new smelter at Clarkdale, Ariz.

Jualin Alaska Mines Company, Jualin, Alaska. One 100 k.v.a. water wheel generator; three 25 k.v.a. transformers; one 75 h.p. motor and one 2-panel switchboard.

Kennecott Mines Company, Kennecott, Alaska: One 500 k.v.a., 80 per cent power factor 480-volt, 3-phase, 60-cycle normal rated turbo generator unit; and one 2-panel switchboard.

Tonopah Belmont Development Company, Tonopah, Nev.: One 125 h.p. motor for direct connection to Nordberg mine hoist; and one 75 h.p. motor for direct connection to Aldrich pump.

Tonopah Merger Mining Company, Tonopah, Nev.; one 250 h.p. 200 r.p.m. synchronous motor with switchboard panel and motor-generator set for driving Sullivan machinery compressor.

Burro Mountain Copper Company, Burro, N. M.: Four 300 k.v.a., and six 100 k.v.a. and three 37½ k.v.a. oil insulated, self-cooled transformers, for a new copper property being developed by the Phelps-Dodge Company.

Beatson Copper Company, Latouche, Alaska: Two 625 k.v.a., 80 per cent power factor 2300-volt, 3-phase, 60-cycle, normal rated turbo generator units; one 6-panel switchboard, and two 16 kw. motor-generator exciter sets.

Keenecotte Mines Company, Kennecotte, Alaska: One 75 h.p. special motor with magnet, brake and automatic control. This motor will be used to drive a tramway and will under certain conditions be operated as a synchronous generator.

Utah Copper Company, Magna, Utah: Four: 10 h.p. special vertical motors for driving agitators for oil flotation. This is the third repeat order for this customer covering motors for an application especially developed by this company.

Anaconda Copper Mining Company, for the Boston & Montana Reduction Works, Great Falls, Mont.: Two 8 ton barsteel locomotives. These locomotives are to be of particularly heavy construction as they will be used for "hunting" charging cars about the smelter.

Anaconda Copper Mining Company, Butte, Mont.: Eight 150 h.p. 14-pole motors, with impregnated winding, to be operated in couples of 300 h.p. for driving quintuplex mine pumps; each complete with automatic auto starter composed of type F magnetic switches and six relays mounted on slate panel and separately mounted auto transformers.

Daly West Mining Company, Park City, Utah: One 175 h.p. 16 pole motor with magnet switch hoist control. This is the first Westinghouse hoist motor to go into Park City and the first Westinghouse magnet switch hoist control to be installed in Utah. One 400 h.p. 150 r.p.m. synchronous motor with exciter and switchboard, for driving a Laidlaw-Dunn-Gordon air compressor. This is the first large Westinghouse motor to go into Park City and the first synchronous compressor motor to be installed in Utah.

Utah Copper Company, Bingham, Utah: Six 1 kw. turbo-generator units. These will be used for supplying light to steam shovels operating in the copper mine. The turbines are bolted direct to the shovel frame and supplied with steam from the shovel boiler. This order for six units follows a trial order for one unit, and the consumer states many shut-downs during night operations have been avoided by making each shovel carry its own lighting outfit, thus doing away with the difficulty of maintaining electric lighting lines in the vicinity of frequent blasting.

Alaska Treadwell Gold Mining Company, Treadwell, Alaska: One 4½ ton storage battery locomotive with two V-50 motors and 68 cells of Edison type A-8 Battery. This locomotive is for 25 in. gauge. Also one 8-ton barsteel trolley locomotive with No 905, 500-volt equipment, steel tired wheels, and D-20 trolley. This locomotive is also for 25 in. gauge. One No. 354 200 h.p. 2200-volt motor with magnet switch control for automatic acceleration. This is the largest electric hoist motor in Alaska and the first magnetic switch control ever installed there.

NEWS OF WASHINGTON PUBLIC SERVICE COMMISSION.

Rules governing all matters relating to wiring for power, telephone and telegraph, and lighting lines have been issued by the public service commission, amending and supplementing the rules prescribed in the act passed at the last legislature. The most important of the new rules specifies in detail the precautions which must be taken in the construction of lines over railroad crossings. Practically every power, telegraph, telephone and lighting company was represented at the hearing recently held at Seattle, Wash., as a result of which the new rules were issued.

S. C. Woldenberg, mayor of Leavenworth, has filed a complaint with the public service commission alleging that the rates charged by the Tumwater Light & Power Company for general electrical service are too high. The city asks an early valuation of the company's properties and asks for the cancellation of an alleged secret contract for the sale of power made with one of the company's customers.

ELECTRICAL CONTRACTORS' DEPARTMENT

ELEMENTS OF SUCCESSFUL CONTRACTING.

BY C. F. BUTTE.

I have been requested to talk to you from a contractor's point of view, and I have taken it for granted that I may take my views with the aid of a wide angle lens and a telescope and touch on many angles and phases of the contractor's daily work, both at close and distant range.

The subjects, some thirty in number, which I will take up bear more upon the daily work with which each of us come in contact, while carrying on our business and will cover subjects our association has at times taken up and information which may prove of value to many of us. No matter what subject is discussed before you at these meetings, no matter what subject or actions an association may take, no matter what efforts may be spent by individuals, unless such actions or efforts result in one thing when applied to our business, namely greater profits, such actions or efforts are not a success. No matter how large or how small any business may be, it cannot be successful unless a profit is shown on the work undertaken, whether it is an order or contract amounting to one dollar or ten thousand dollars.

Only through efforts such as have been made at meetings of the character of today, can we obtain the desired result. Information disseminated through such talks as we have heard, data and tables will be of inestimable value to the electrical contractor, who is supposed to know all branches of the electrical business. He is supposed to know the various contract forms of all the power companies, the class of services in all parts of the city, must be familiar with every appliance, device or fitting made by all of the many manufacturers, some ten thousand or more in number, must know where to get the proper materials, must know the many rules and regulations of the National Underwriters and local departments, as well as the idiosyncrasies of the different local inspectors, must understand the many methods of building construction, must understand and interpret somewhat indefinite and indifferent plans and specifications and agree to furnish all items and materials essential, whether specified or not, must be a good judge of workmen and workmanship, must be able to correctly test and report and give advice on motors, generators and electrical machinery, and be willing to give bids to correct any fault or damage and back up his judgment with his capital by spending money for labor and material to correct the trouble and from the time he starts until he stops the contractor is "going some." In fact, the contractor must be like the widower who married a widow and had to decide why his six boys and her six boys were fighting their six boys. It therefore behooves all of us to gather as much knowledge and advice through associating with one another as possible.

The four subjects paramount to all other subjects in any contractor's business, are: Proper estimating, getting the business, a proper cost upon completion of work, and the collection of the bills. All other parts of our business or in fact of any business are incidental to these four subjects.

Proper Estimating.

Estimating properly is something overlooked by many contractors and indeed seems to be the most vital question we have to handle. The fact that a considerable variation may exist in bids that may be submitted on a contract, does not always indicate that some error has been made by the estimator, however wide the variation may be, but it shows that some differences in interpretation of the plans and specifications exists, it indicates that some vital factors in the handling of the business are unbeknown to the estimators, it indicates that some estimator is forced to get the contract to hold his job as an estimator, it indicates

that there may be some angel backing the concern and the manager makes one job cover up the loss on the other as long as the angel's wings can be clipped, it indicates that some preference is given or that a joker exists in the specifications, it indicates that a standard is sorely in need for estimating purposes, a standard not only in the method of estimating, but a standard for materials, a standard for quality, a standard for construction. This question leads us also to the point of standardizing specifications. There may be no question what class of material a specification may call for, but, does the specification cover quality in all respects? Uniform, concise, definite specifications and specifications that are complete would certainly rectify many of the evils of estimating existing at the present time and would mean that all competitors who figure and bid on the work covered thereby, would know exactly what is wanted, how the work must be done and therefore, would base their estimate on the same class and character of work. Unquestionably, the many varied bids now prevailing in the award of a contract would be reduced and more uniform and better conditions would prevail could this ideal condition be obtained in the writing of specifications. Not only would we be benefitted as stated before, but we would also know what we should prepare for in advance of receiving any contract; our stocks of materials could be handled more economically and better, our standards of constructions could be more readily grasped by our men, thereby raising their standard and efficiency, our bulky detail work could be reduced and in many ways our efforts and work reduced, thereby increasing our profits without increasing our costs. A condition of this kind can never be obtained by individual effort, but must be carried on continuously by the concerted effort of all association members, each and all working collectively and individually through their association.

Many of the leaks, many of the mistakes and many detrimental contracts would be avoided and stopped by a standard specification and many charges to experience would be saved the contractor, again showing a profit. Furthermore, a standard specification would raise the quality of the work, as it is human nature collectively to standardize the best and not the poorest. We also find many specifications that are practically excerpts from the code in addition to the clause that the work must comply with the N. E. C. and local rules, while frequently these same specifications are very indefinite on points that should be fully covered. This lack of definiteness is liable to furnish a contractor reasons to bid on inferior work, such as ordinary plug cutouts instead of panel boards and switches, wood planking for main switchboard and many items of this kind, as long as it will pass inspection.

The education of the public in demanding and using standard electric materials and wiring would aid greatly to the adoption of standard specifications, as it is a fact that the public is our consumer even though dealing through an architect or engineer. We may say that the real cause for lack of a standard in specifications is the ignorance of the layman regarding the difference in quality of materials and work, as most of it is concealed when they see it, and as long as the lamp brightens, even if not up to full candlepower, they believe the work is well done. In contracting for other things and in the purchase thereof the average citizen seldom considers lowest price, but generally considers quality. Brown could buy a suit of black cloth for \$12.50 but, does he not pay \$25.00 instead, as it is of better quality? Is it not reasonable to presume he would do the same if he knew something about the quality of electrical materials? The time that it would require to educate the public to this point may take longer than we could claim on this world.

but let us endeavor to educate the architects and engineers to this point assiduously and hasten the termination of chaotic conditions.

A standard for materials of equal quality although made by different manufacturers would aid greatly towards obviating unpleasant arguments with owners and architects. A standard of this kind would also correct the chaotic condition of our stocks, as we now have many brands of the same thing on our shelves.

The contractor is not entirely free from blame for any chaotic conditions that may exist at the present time, as many contractors could not be depended upon to recognize quality for materials and construction, but rather than lose a contract would base their bids on inferior and poorer construction and materials.

Another deficiency prevalent with our fellow members and competitors, and which seems a common fault with all of us, is the lack of importance given to the consideration of items of expense and unproductive labor costs, that enter into our costs to carry on our business.

The items that constitute overhead expense are many. In brief, any expenditures in salaries, rents, light and power, stationary telephones, cartage charges, stock losses and in fact any expenditures that cannot and are not charged directly to the costs of your work should be considered as overhead expense. The following lines will vividly convey the necessity of knowing something about your overhead expense and the application of your knowledge in your work.

Of bookkeeping I knew nary a line,
Of credits and finance the same;
But still, I went into the business
Of wiring—a wonderfully easy game.

I never considered such trifles as rent,
And taxes and insurance, thought I,
Were small considerations after they were spent—
My profits would show bye and bye.

What knew I of overhead expense,
Or of the items of which it was made?
They told me it was at least 34 and six-tenths,
The monthly amounts which I had paid.

There were thirty-nine reasons all together
Why I failed and was put on the "run,"
The thirty-ninth and most important was—
I should never have begun.

Getting the Business.

Initiative is unquestionably the keynote and answer to getting the business. We only need to look around a wee bit to see that this one word explains the success of all our successful business men, all of our great workers, all of our great inventors, and all of our great men. Can we not trace the wonderful work of Thomas A. Edison to initiative? Was not the great work of George Westinghouse due to initiative? Is not the success of any of our great business concerns of the present day due to initiative? This one word will explain how to get the business and no matter how brilliant a man may be, no matter what capital may be available, no matter what resources or qualifications may be commanded, if initiative is not combined therewith success cannot and will not be obtained. This world will not and does not want at the pinnacle of success any man who does not do the right thing at the right time without being told. The world only bestows its big prizes, honor, money and success, for this one thing initiative.

Service is another quality essential for getting the business. While this word is undoubtedly overworked, the action unquestionably is underworked.

Service to your regular customer even though he may not have an order at the time, but wants to know about something that you should know about, is an item frequently neglected. Service means to get your men at the job at the hour promised and when the job is completed it will be the job done and not the customer. Service means to be prepared for any emergency that may arise, and to be able to handle any matters pertaining to your business without delay. Service means to have men available by rearranging work on hand to take care of any urgent case, and give your customer power or light with least possible delay.

Frequently one hears of other branches of the building industry calling upon a contractor to take care of certain work at once and when the men arrive at the building the work cannot be done for several days hence. Do you know why this occurs? The writer has investigated several of these cases and invariably the same reply is given, "You electrical contractors are always a couple of days behind in your promises and for this reason we call up beforehand to be sure the men will be on the job in time."

Fellow-contractors, we must correct our own faults before we can correct the faults of other branches of the business and profession. In many ways you can show your old customers and prospective customers through accommodation and service, that their orders and business should be handled by you, and with initiative and progressive actions you undoubtedly will succeed in landing many orders and contracts.

Service is also a vital factor in obtaining proper costs in your work, service in handling your materials, service in furnishing the necessary tools, and service in furnishing your men with the proper information, plans and working layouts. Do you all realize the labor lost unnecessarily by the starting and carrying on your work with insufficient information and working layouts? Can you expect your men to work efficiently, economically and rapidly if they must ravel into a set of plans consisting of many sheets each time they start a run of conduit? Can you expect your men to complete the work within reasonable time, if they must stop and start on the same parts several times on account of lack of detail?

Do not always blame the man who performs the work when the labor costs on your work is high. First investigate and discover the reasons therefor, and possibly it may be on account of delinquent service over which the man had no control. I say "over which the man had no control" for the reason that service enters in a considerable degree into the work the men perform over which the man has control. Can you believe that the average man uses only ten per cent of his brain cells and ten per cent of his physical powers? This average was deducted after careful research over a long period by the late Professor James of Harvard. The statement made is possibly very startling, however, is it not true that man's failure can be traced to mental and physical inefficiency and lack of power to concentrate and apply the qualities that he may possess? Have you not heard of men who are efficient when working for one contractor and inefficient when employed by another? The reason is human inefficiency, either on the part of the employer or employee, and should be overcome by the development of human efficiency. All these factors enter into the costs of your work and are vital to all of us, as our profits depend upon our costs when contracts are completed.

The material item is also a vital factor in your ultimate cost, not only in the sense of purchases, but also in the manner in which it is handled, supplied and delivered to the work.

The shortage of material on your work is an evil for which there is absolutely no excuse. However you must admit that such shortages do exist. I do not include materials that are required for alterations or changes made in the work as it is underway, but materials which you knew about before the work was started.

(To be continued.)



NEWS NOTES



FINANCIAL.

SAN FRANCISCO, CAL.—The finance committee of the Supervisors has concluded to allow the Pacific Gas & Electric Company \$1000 as a compromise on its claim for lighting last year during the period when it was involved in labor troubles.

NEWPORT, CAL.—An ordinance has been adopted by the city council providing for the issuance and sale of city bonds in the sum of \$20,000 for the acquisition and construction of a municipal electric lighting system, consisting of posts, lighting fixtures, lamps, wires, cables, conduits, etc.

SEATTLE, WASH.—At a meeting of the council held during the past week ordinances were passed ratifying and confirming the loan of \$400,000 from the \$1,400,000 bonds voted in November, 1910, for enlarging the light plant, and ratifying and confirming the loan of \$404,000 of the \$425,000 light and power bond issue.

ESCONDIDO, CAL.—Word has been received from the State Board of Control that it will take \$75,000 of the \$100,000 municipal water plant bonds. The other \$25,000 will be taken by private parties. Plans for the water plant will be carried forward without delay. They call for a pumping plant along the Escondido River, building of an impounding reservoir, and construction of a complete distributing system.

SAN FRANCISCO, CAL.—The United Railways Investment Company has paid the installment of \$200,000, together with interest now due on its issue of 6 per cent serial notes. The block paid off is designated as series "L." With this payment there is left \$1,100,000 of the original issue. The notes were put out to acquire \$3,500,000 of first preferred stock of the United Railroads of San Francisco and are secured by deposit of that stock and by \$1,500,000 additional previously acquired.

ILLUMINATION.

ABERDEEN, WASH.—The city council has granted the gas franchise asked by L. H. Burnett and his associates.

CHICO, CAL.—The Development Committee of the Chico Business Men's Association is promoting the installing of electroliers in the main streets of the city.

SAN JOSE, CAL.—Plans and specifications for the highway lighting of Willow Glen lighting district have been prepared. Bids will be opened September 8th.

PASADENA CAL.—Six bidders submitted bids on the steam turbine unit and generator for the municipal light plant. Some of the bids ran as high as \$50,000 for the combination.

POMONA, CAL.—Work will begin shortly on the installation of ornamental street lights in this city. A system for the entire business district and probably the residence district is planned.

FALLON, NEV.—The Nevada Valleys Power Company has applied for a franchise to transmit electricity for lighting and power purposes along certain public roads in Churchill county. The granting of the franchise will be filed September 8th.

MANHATTAN, CAL.—The California Edison Company has been awarded a contract for lighting Wiseburn road from Farrell to Gould street and the lighting of Farrell street from Herrin to Wiseburn street. The system will be installed immediately.

BOISE, IDAHO.—The public utilities commission has granted a certificate of public convenience and necessity to Dunkle Bros. who have formed a co-partnership to install

an electrical generating plant in the town of Plummer to furnish electricity for lighting and power purposes.

FLORENCE, ARIZ.—Mr. Arthur, general manager for the Douglas Investment Company, holding company of the Florence Improvement Company, is considering the installation of an electric plant in this town. A light franchise will be submitted to the council in the near future.

TRANSMISSION.

CORDOVA, A. T.—The council has introduced an ordinance granting a light and power franchise to Harry H. Knox.

OREGON CITY, ORE.—The franchise of the Clackamas County Gas Company to lay mains on Whitehouse road to Oswego has been granted by the county court.

SEATTLE, WASH.—Nettleton, Bruce, Eshbach Company at \$164,565, submitted the low bid to the board of public works for completing the Cedar River dam.

PHOENIX, ARIZ.—The Hydraulic Power Company, which owns and operates the Fossil Creek power plant, contemplated constructing a larger plant on upper Verde River and furnishing power to a number of communities in Yavapai county.

VANCOUVER, WASH.—A hearing will be held by the Board of County Commissioners on September 11th on the proposed franchise of the Western Light & Power Company asking right to operate a power line along certain roads in Clark county.

CENTRALIA, WASH.—The Independent Electric Company, a subsidiary of the Washington-Oregon Corporation, has petitioned for a license to construct electric light and transmission lines along the Winlook and Cowlitz road. The board set September 10th as the date of hearing the application.

DRAIN, ORE.—A contract has been signed with the Douglas County Light & Water Company for furnishing electric current to this city. This calls for the extension of the line from Oakland north at once. John W. Hogg of Sutherlin has been engaged by the council to superintend the installation of the distributing system.

LEWISTON, IDAHO.—On the motion of Commissioner Fred Emery, who has long championed the construction of a dam and power site on the Clearwater River near Porter's slough, the city council authorized the employment of James Morris, engineer of Portland, to come to Lewiston and after examination supply the council with preliminary data relative to the estimated cost of construction, the amount of power to be derived and the cost for distributing the same and other necessary information.

LOS ANGELES, CAL.—The protest of property owners on Forty-fifth street, in the Vermont Square district, against the Southern California Edison Company, and their insistence that the poles be placed in the alleys, has brought forth from the board of public works a renewed declaration of its policy on this line. The board has declared that it is its intention to compel the placing of poles in alleys in such tracts where such construction can be made at a reasonable expense, and it has so notified the public utilities companies. The change of the poles from Fifty-fifth street can be made for about \$500.

LONG BEACH, CAL.—The city council has demanded that public service corporations remove poles and take overhead wires from the business district. The Southern California Edison Company and the Sunset Telephone have

complied, agreeing to start on the improvement soon. The district in which the companies will run their wires in underground conduits is bounded by the ocean, Third street, Elm and Chestnut avenues. The cost of the improvement will approximate as follows: Edison Company, \$60,000; Sunset Telephone Company, \$20,000; Home company, \$12,000. According to the agreement between the city and the two larger corporations, the work of removing the poles and wires and placing them underground must be finished by December 31, 1915. The two concerns have agreed to extend the conduit system.

WINNEMUCCA, NEV.—At a special meeting of the county commissioners the Nevada Valleys Power Company presented an application for a franchise for electric light and power lines throughout Humboldt county. Action will be taken by the commissioners at the October meeting. The company is a Nevada corporation, with head offices in Reno. Edson F. Adams is president of the company and F. J. Early is secretary. The petition is for a blanket franchise, giving the company the use for its purposes of all the public roads and highways and streets and alleys of all the unincorporated towns and villages in Humboldt county. It is understood that this is the company which proposes to bring electric power into Rochester, its line running through Lovelock and Oreana. The power is to be transmitted from the government's plant at Lahontan, in Churchill county. From the fact that a blanket franchise is asked for, it is presumed that the company proposes to eventually extend its lines to other parts of this county.

TRANSPORTATION.

SEATTLE, WASH.—The council introduced an ordinance authorizing the purchase of auto street cars.

TACOMA, WASH.—The supreme court has handed down a decision upholding the validity of Tacoma's \$35,000 bond issue for the municipal car line.

TACOMA, WASH.—Bids will be received by Public Works Commissioner Woods September 8th for steel for the municipal car line. A five per cent check must accompany bid.

SACRAMENTO, CAL.—The first of the six modern pay-as-you-enter street cars purchased by the Pacific Gas & Electric Company for use in Sacramento will arrive from St. Louis by September 1st, and two will be put in operation here by September 6th. Within 30 days the other four are scheduled to arrive and be put in operation.

POCATELLO, IDAHO—The council has granted a franchise to J. D. Browning for the construction of a street railway system. The franchise calls for 1½ miles of operating line to be constructed the first year and the same amount of mileage in each of the two following years. The company to be organized will probably be known as the Pocatello Traction Company.

OAKLAND, CAL.—A new timetable was put into effect August 24th by the Oakland, Antioch & Eastern Railway, showing six trains making direct connection from and to points on the Northern Electric Railway and the Sacramento & Woodland Railway via Sacramento. It will enable passengers to make direct connections from and to Marysville, Yuba City, East Gridley, East Diggs, Oroville, Chico, Colusa, Live Oak and Woodland. A fast schedule between these points and Oakland, Berkeley and San Francisco has been arranged for the new timetable.

PROVO, UTAH.—Seven hundred and fifty residents of Salt Lake City, Provo and intervening towns along the new Orem Interurban electric line celebrated the formal opening of this line in Provo on August 14th by a banquet given by the Provo Commercial Club. A special train over the Orem line carried 120 passengers from Salt Lake City and Ogden. Governor William Spry, Mayor C. T. Decker

of Provo, and Mayor Samuel C. Park of Salt Lake City, spoke of the great benefit which this new line will be to the territory served by it and urged the residents along the line to give the company their loyal support. W. C. Orem, president of the Salt Lake & Utah Railroad told the story of its promotion and reviewed in brief the history of the construction work. He thanked the county and city commissioners present for their aid and help in granting franchises and for generally co-operating with the officers during the construction of the road.

VALLEJO, CAL.—Attorney Theo W. Chester, representing the Northern Electric road, accompanied by Superintendent W. A. McGovern and Jas. W. Grace, claims agent, appeared before the city council and asked that the franchise of the railroad be extended. When the franchise was given the railroad in February, 1911, it was agreed that the work should be completed in three and a half years. This has not been done and unless some provision is made to extend the time, the Northern Electric will lose its local rights. Chester explained to the council that the road had been handicapped by a very weak money market, but that indications were that the work could be completed next year. The council finally decided to take the matter under advisement, although it is possible that some changes may be made in the new franchise which will be issued. Chester read a statement showing that the company had recently put \$120,000 in improvements which was intended to show that it really meant business. He also said that work will be resumed at this terminal as soon as the money is available.

TELEPHONE AND TELEGRAPH.

OREGON CITY, ORE.—The county court has granted a franchise to the Home Telephone & Telegraph Company to construct a line to Lake Shore Villas on Oswego lake.

STEVESTON, B. C.—Negotiations are going rapidly forward whereby the Farmers Telephone Company, of Lulu Island will be absorbed by the B. C. Telephone Company.

EVERETT, WASH.—A permit has been granted to the Postal Telegraph Company by the county commission to place an entirely new line of wires across Snohomish county.

SAN FERNANDO, CAL.—The city council has granted permission to the Consolidated Securities Company to transfer its telephone franchise to the San Fernando Telephone & Telegraph Company.

VALDEZ, A. T.—The Valdez Electric Company is planning an extension of its telephone system to Camp Comfort, possibly to Wortman, on the government road and to the head of Mineral Creek.

EUGENE, ORE.—The county court has granted a franchise to A. H. Tyson for the construction and operation of a private telephone line over the county roads in Ferland addition to Santa Clara.

COLFAX, WASH.—The board of county commissioners is considering the application of H. G. Kirkpatrick of Tekoa for a telephone franchise for a line from Tekoa to Plummer and De Smet Mission, Idaho.

SILVER CITY, N. M.—A telephone line to extend from a point near Hanover to ranger headquarters, 7 miles above Mimbres, is now under construction by the forest service. L. V. Slonaker is in charge of the work.

LA JOLLA, CAL.—The Pacific Telephone & Telegraph Company is contemplating improvements to the amount of \$9000 on its local branch. The plans call for a general overhauling and outfitting of the entire plant.

RIVERSIDE, CAL.—Bids will be received up to September 21st by the board of supervisors of Riverside county, for a franchise to maintain a telephone and telegraph system in the town of Blythe, application for which was made by Floyd Brown.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page opposite

A-1	American Ever-Ready Works of National Carbon Co.... Los Angeles; 755 Folsom Street, San Francisco; Seattle.	M-2	McGlaulin Manufacturing Co.....11 Sunnyvale, Cal.
B-1	Benjamin Electric Manufacturing Co..... Rialto Bldg., San Francisco.	M-4	Morse Chain Co..... Monadnock Bldg., San Francisco.
B-3	Blake Signal and Manufacturing Co..... 680 Howard Street, San Francisco.	M-3	Moore & Co., Charles C..... Van Nuys Bldg., Los Angeles; Spalding Bldg., Port- land; Kearns Bldg., Salt Lake City; 40 First Street, San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.
B-5	Bridgeport Brass Co..... 4 (See Pierson, Roeding & Co.)	N-1	Nason & Co., R. N..... 151 Potrero Avenue, San Francisco.
B-7	Busch-Sulzer Bros.-Diesel Engine Co..... 5 Rialto Bldg., San Francisco.	N-2	National Conduit & Cable Co., The..... Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco.
C-1	Century Electric Co..... 3 614 South Grand Avenue, Los Angeles; 56 Natoma Street, San Francisco; Seattle; Spokane.	N-3	National Lamp Works of G. E. Co..... (All Jobbers.)
C-2	Colonial Lamp Works..... 444 Market Street, San Francisco.	N-4	New York Insulated Wire Co..... 629 Howard Street, San Francisco.
C-3	Crocker-Wheeler Co..... Title Insurance Bldg., Los Angeles; Salt Lake City; First National Bank Bldg., San Francisco; Seattle.	O-1	Okonite Co. (The) .....14 (All Jobbers.)
C-5	Crouse, Hinds & Co..... 5 Chicago, Ill.	O-2	Olston Electric Stove Co.....11 1312 E. 12th Street, San Francisco.
C-4	Cutler-Hammer Manufacturing Co..... 579 Howard Street, San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.	P-2	Pacific States Electric Co..... 2 236-240 So. L. A. Street, Los Angeles; 90 Seventh Street, Portland; 526 Thirteenth Street, Oakland; 575 Mission Street, San Francisco; 307 First Avenue, So., Seattle.
D-1	D. & W. Fuse Co..... (All Jobbers.)	P-4	Pelton Water Wheel Co.....11 2219 Harrison Street, San Francisco.
D-2	Dearborn Drug and Chemical Works.....11 355 East Second Street, Los Angeles; 301 Front Street, San Francisco.	P-5	Pierson, Roeding & Co..... 4 Pacific Electric Bldg., Los Angeles; Spalding Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle.
E-1	Edison Lamp Works of General Electric Co..... Rialto Bldg., San Francisco.	P-7	Pittsburgh Piping & Equipment Co.....14 Monadnock Bldg., San Francisco.
E-2	Edison Storage Battery Supply Co.....11 441 Golden Gate Avenue, San Francisco.	S-1	Schaw-Batcher Company, Pipe Works, The..... 211 J Street, Sacramento; 356 Market Street, San Francisco.
E-3	Electric Agencies Co..... 247 Minna Street, San Francisco; Central Building, Los Angeles.	S-2	Simonds Machinery Co..... 117-19-21 New Montgomery Street, San Francisco.
E-4	Electric Storage Battery Co..... Pacific Electric Bldg., Los Angeles; Spalding Bldg., Portland; 118 New Montgomery Street, San Francisco; Colman Bldg., Seattle.	S-3	Simplex Electric Heating Co.....14 612 Howard Street, San Francisco.
F-1	Fairbanks, Morse & Co.....14 Los Angeles; Portland; 651 Mission Street, San Fran- cisco; Seattle; Spokane.	S-4	Southern Pacific Co.....13 Flood Bldg., San Francisco.
F-2	Fort Wayne Electric Works of G. E. Co..... Rialto Bldg., San Francisco; Colman Bldg., Seattle.	S-5	Sprague Electric Works of G. E. Co.....13 Rialto Bldg., San Francisco; Colman Bldg., Seattle.
G-1	General Electric Co..... 12 124 W. Fourth Street, Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane.	S-6	Standard Underground Cable Co..... First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland; Central Bldg., Seattle, Wash.
H-1	Habirshaw Wire Co..... (See Western Electric Company.)	T-1	Thomas & Co., R..... (See Western Electric Co.)
H-2	Hemingray Glass Co.....11 330 So. L. A. Street, Los Angeles; 345 Oak Street, Portland; 807 Mission Street, San Francisco.	V-1	Van Emon Elevator Co..... 56 Natoma Street, San Francisco.
H-3	Hoaglund-Hulse Electric Co..... 1707 Naud Street, Los Angeles.	W-1	Wagner Electric Manufacturing Co..... 5 Rialto Bldg., San Francisco.
H-4	Holophane Works Aronson Bldg., San Francisco.	W-2	Western Electric Co..... 119 East Seventh Street, Los Angeles; 507 Sixteenth Street, Oakland; 680 Folsom Street, San Francisco; 907 First Avenue, So., Seattle.
H-5	Hunt, Mirk & Co..... 141 Second Street, San Francisco.	W-4	Westinghouse Electric and Manufacturing Co..... 6 50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Central Bldg., Seattle; Paulsen Bldg., Spokane.
H-6	Hubbard & Co..... Rialto Bldg., San Francisco.	W-5	Westinghouse Machine Co..... 141 Second Street, San Francisco.
I-1	Indiana Rubber and Insulated Wire Co..... 3 807 Mission Street, San Francisco.	W-6	Westinghouse Lamp Co..... (See Westinghouse Electric and Manufacturing Co.)
K-1	Kellogg Switchboard and Supply Co.....13 Aronson Bldg., San Francisco.	W-7	Weston Electrical Instrument Co..... 3 682 Mission Street, San Francisco.
K-3	Klein & Sons, Mathias 5 579 Howard Street, San Francisco.	W-8	Western Pipe & Steel Co..... 444 Market Street, San Francisco; 1758 North Broad- way, Los Angeles.
K-4	K-P-F Electric Co..... 37 Stevenson Street, San Francisco.		
L-1	Leahy Manufacturing Co.....11 Eighth and Alameda Streets, Los Angeles.		
L-2	Locke Insulator Manufacturing Co..... 4 (See Pierson, Roeding & Co.)		
M-1	Mannesmannrohren-Verke Rialto Bldg., San Francisco.		

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906 at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXIII No. 10

SAN FRANCISCO, SEPTEMBER 5, 1914

PER COPY, 25 CENTS



SYSTEM OF WASHINGTON WATER POWER COMPANY

BY C. F. UHDEN

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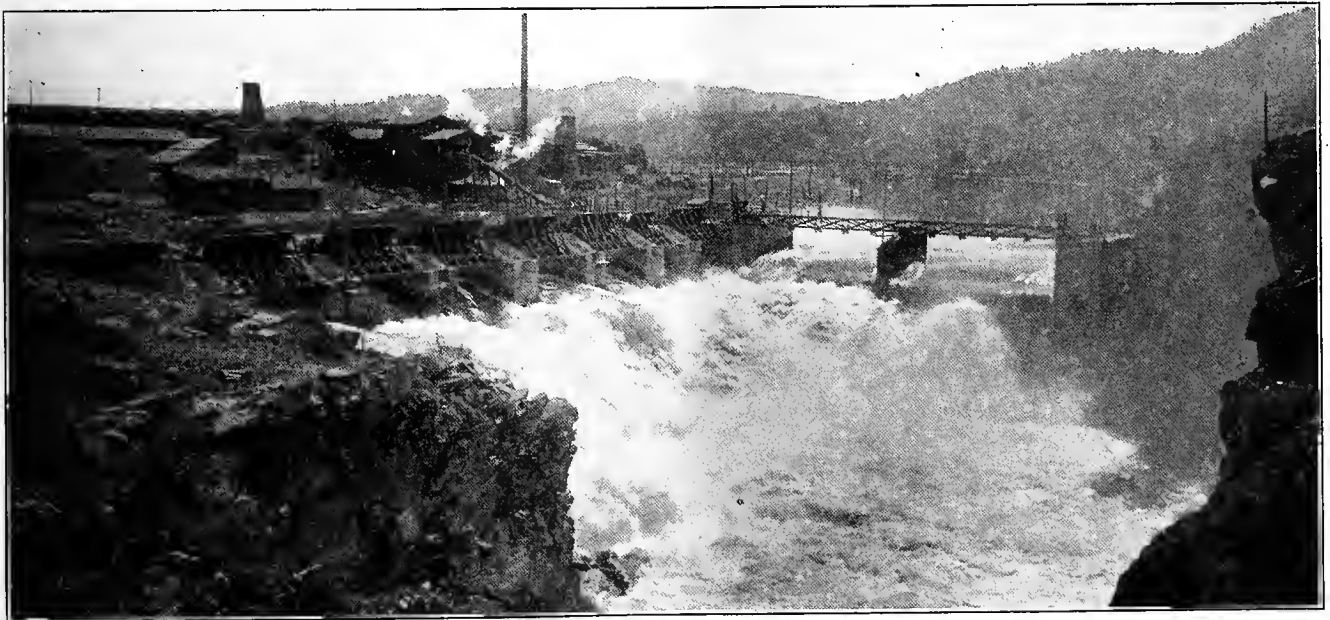
SYSTEM OF WASHINGTON WATER POWER COMPANY

BY C. F. UHLEN.

(After a general illustrated description of the entire system of the Washington Water Power Company, the author gives a detailed account of the construction of the company's new Long Lake Development. Mr. Uhlen is chief engineer for the company.—The Editor.)

The Washington Water Power Company supplies electrical energy for light and power in all the towns and cities of the Inland Empire lying within a radius of 100 miles from Spokane as the center. This energy is transmitted by means of 600 miles of 60,000 volt transmission lines, extending into the various

low the lake, completed in 1906. At this point the river divides into three channels, the North, South and Middle channels. The North and South channel dams contain the controlling gates, which can be manipulated so as to raise the head waters 10 ft. above the normal low water stage.



North Channel Gates of the Post Falls Plant.

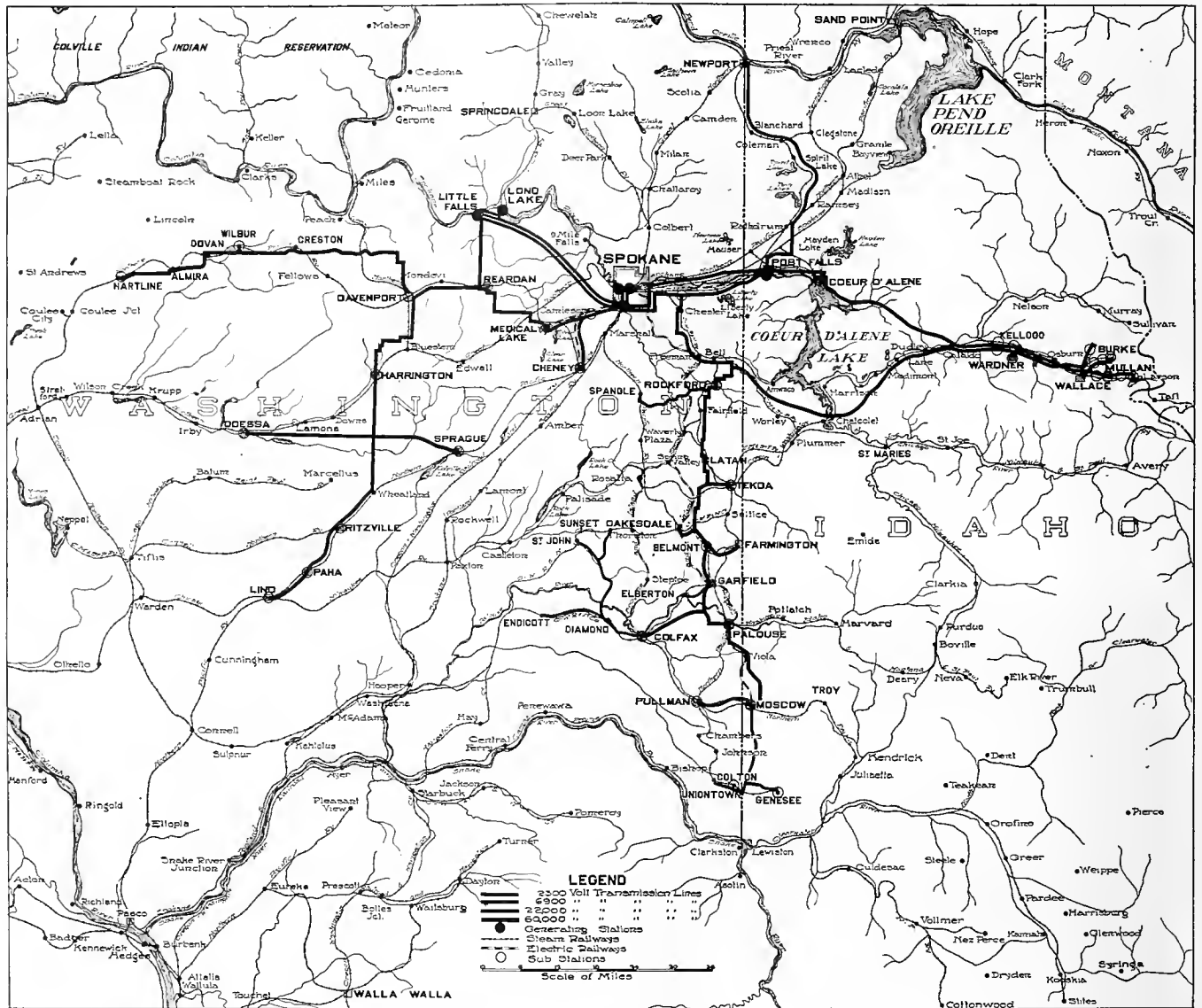
districts, the most important of which is the Coeur d'Alene mining district, producing nearly 1/3 of the lead output of the United States.

All the hydroelectric developments of the company are situated on the Spokane River, three being in operation and one in course of construction, there also being a steam auxiliary in Spokane. The Spokane River, which has a maximum flow of 40,000 sec. ft. and a natural minimum of 1500 sec. ft., has its source in Lake Coeur d'Alene which has an area of 45 sq. miles, and is used as a storage reservoir for a depth of 6 ft., thus allowing a considerable increase of flow over natural minimum during the 120 day low water period.

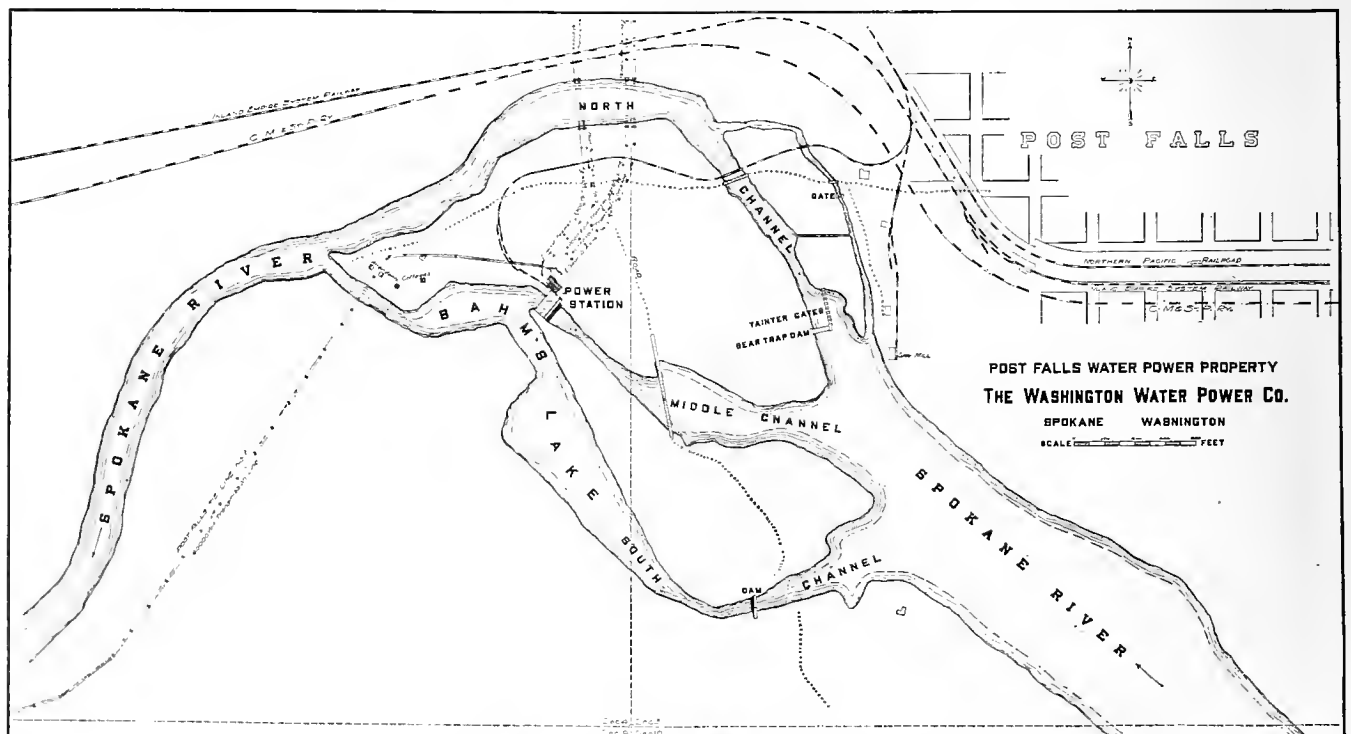
This storage is accomplished by means of dams and gates at the Post Falls plant about 10 miles be-

The North channel gates consist of two 53 ft. bear traps and eight tainters, seven of which are 21 ft. wide and one 12 ft. wide. The South channel dam has 6 gates, each 6x13 ft. and a 37 ft. spillway.

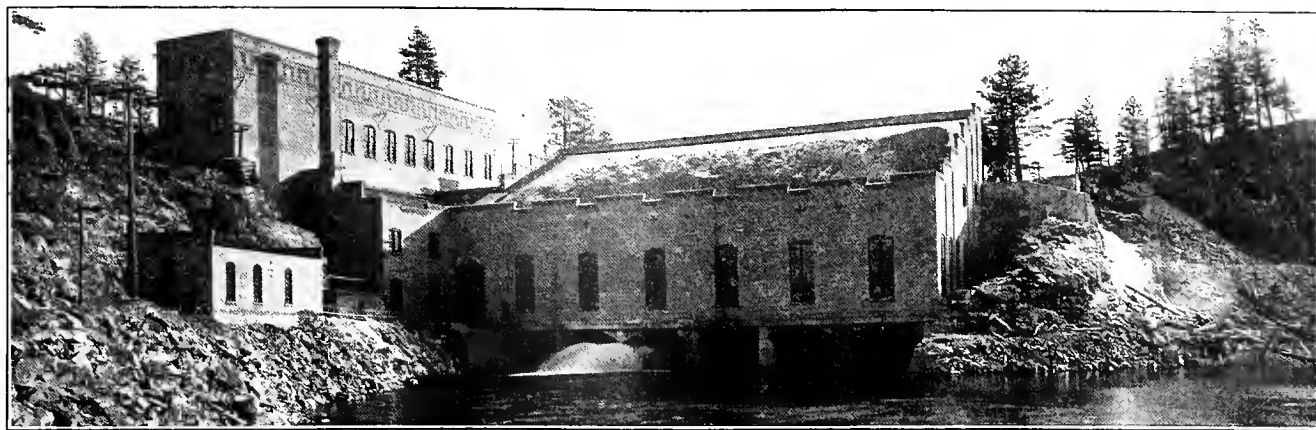
In the Middle channel are the head gate dam and power house. The station is designed for an ultimate installation of six units, of which five are installed at the present time. Each unit consists of a horizontal Francis central discharge, double runner water wheel, operating under a head of 50 ft. Four of the wheels were manufactured by the Platt Iron Works and one by the I. P. Morris Company. Each wheel is direct connected to a 2250 kw., 2300 volt General Electric generator. The transformers are three-phase, 2250 kw. stepping up from 2300 to 60,000 volts. The station has five outgoing lines, four of which are 60,000



Map of Washington Water Power Company's System.



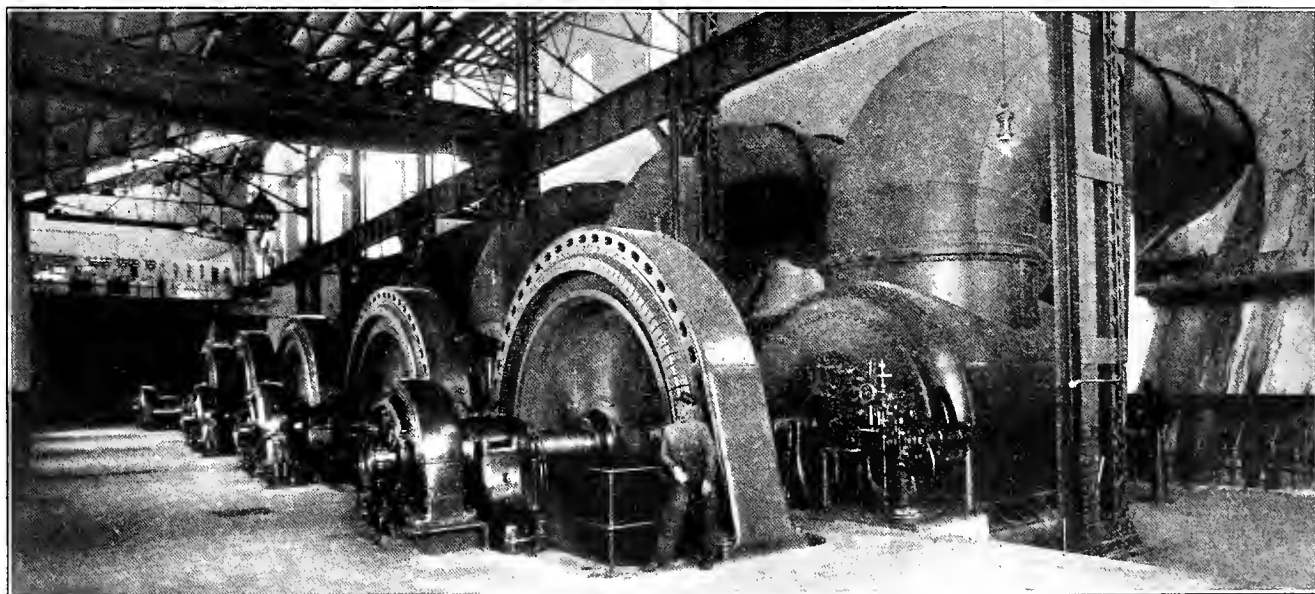
Map of Post Falls Development.



Post Falls Head Gate Dam and Power House.

volt and one 23,000.' Two of the 60,000 volt lines connect with the Twenty-ninth Avenue substation in Spokane, one feeds the Coeur d'Alene Mining District, and the fourth runs north to Newport. The 23,000 volt line furnishes current to the Inland Empire Railway System.

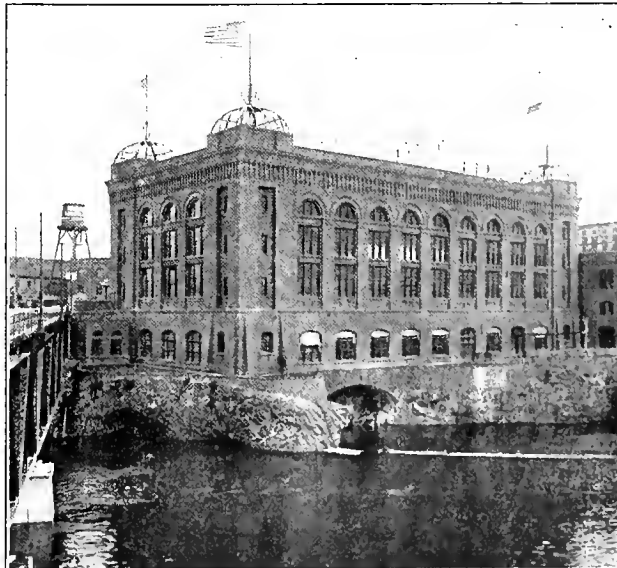
At the lower falls, within the heart of the city of Spokane, is the original hydroelectric station of the company, (see illustration on front cover.) This station operates under a head of 74 ft., and has a capacity of 8800 kw. Two of the units consist of Platt Iron Works Francis turbines direct connected to 2250



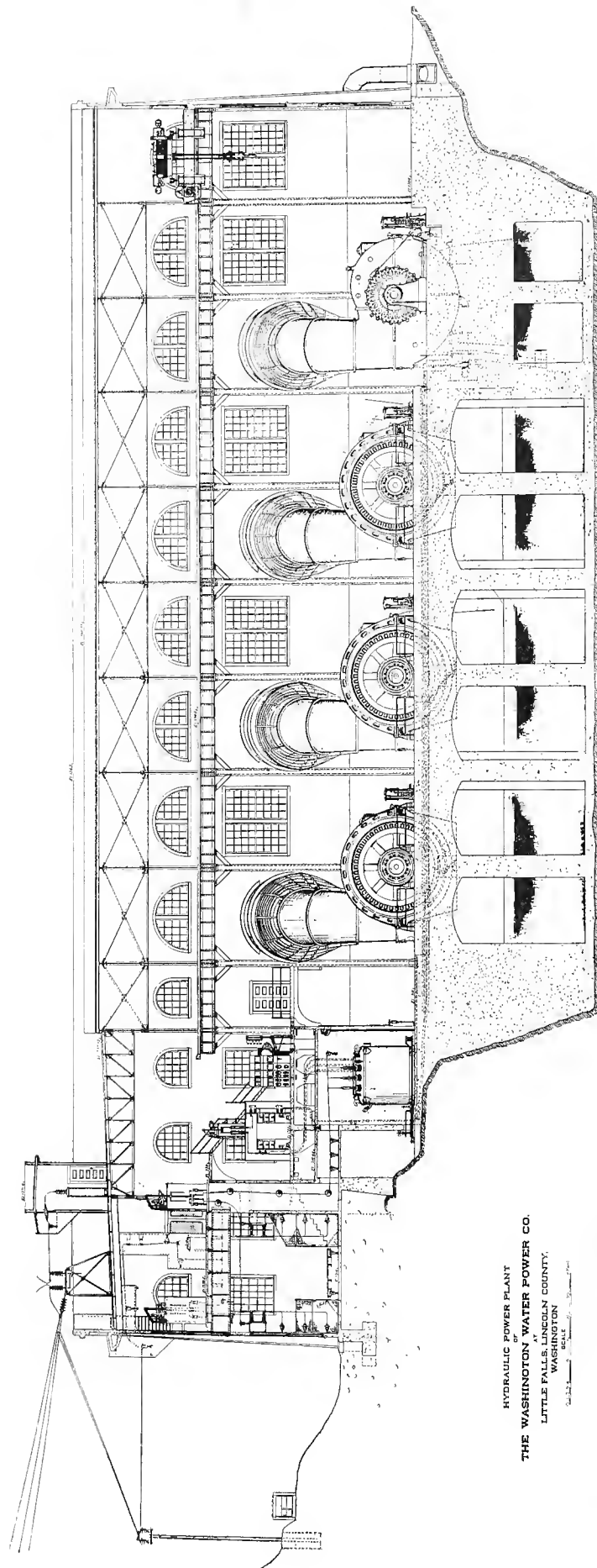
Interior of Post Falls Plant.



Auxillary Steam Plant at Spokane.

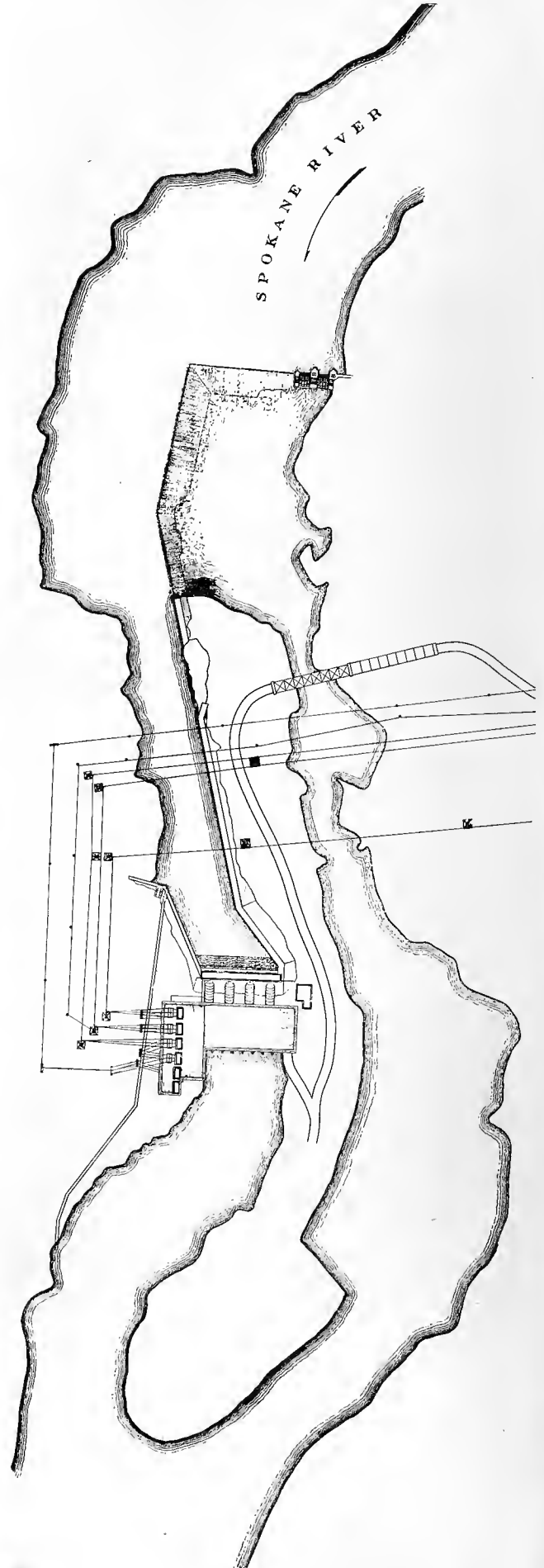


Post-Street Substation at Spokane.



HYDRAULIC POWER PLANT
THE WASHINGTON WATER POWER CO.
AT
LITTLE FALLS, LINCOLN COUNTY,
WASHINGTON

Vertical Section of Little Falls Plant.



Map of Little Falls Development.

kw. 4000 volt a.c. generators, and the rest of the units are composed of water wheels and d.c. generators of various sizes ranging from 200 to 1200 kw.

In addition to this hydroelectric plant, there is also in Spokane an auxiliary steam plant, the Post Street substation, and the Twenty-ninth Avenue substation. The auxiliary steam plant, which is situated about a mile from the center of the city, contains twelve 500 h.p. Babcock and Wilcox boilers and 2 Curtis vertical steam turbines connected to 13,000 volt General Electric generators, having a capacity of 9000 kw. and 6000 kw. respectively.

ft. head, running at 150 r.p.m. Each generator is guaranteed to operate continuously under a 25 per cent overload.

The dams which back the water in the river about $4\frac{1}{2}$ miles to the tail race of the Long Lake plant are of cyclopean construction and have an aggregate length of 1716 ft. The spillway dam, which varies in height up to 64 ft., is 650 ft. long, including two 25 ft. tainter gates.

The wooden pole lines and a double circuit tower line leave this station, the former running to Long Lake and the Big Bend country, and the latter (in a

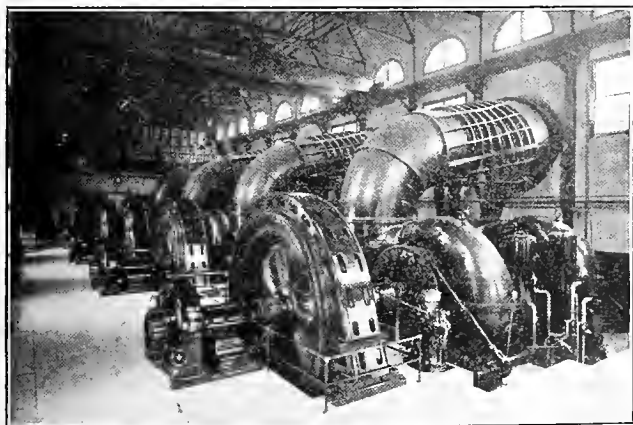


Little Falls Hydroelectric Plant.

The Post Street substation is also situated in the heart of the city, and is designed for an ultimate capacity of 30,000 k.w., the present installation being 12,000 kw. From this station practically all the current used in Spokane is distributed.

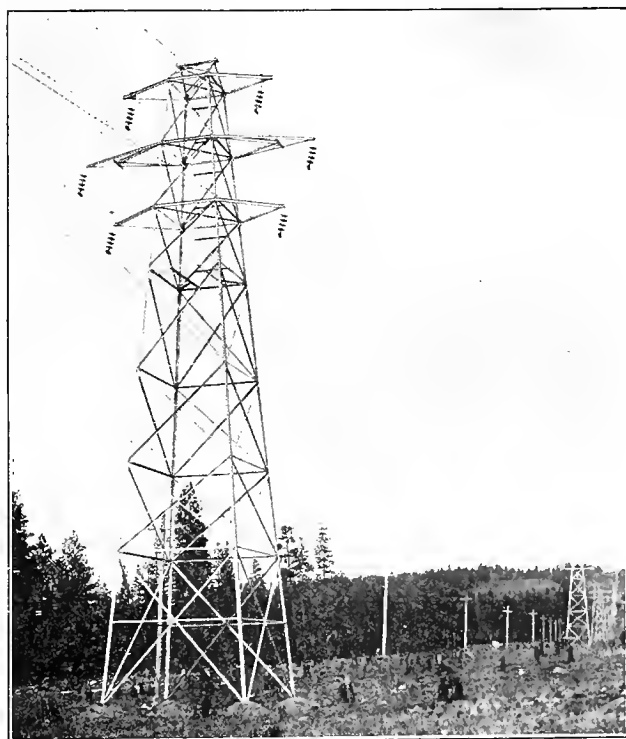
The Twenty-ninth Avenue substation is a high tension switching station, from which all the 60,000 volt lines radiate into the various districts and to the various plants.

direct line) to the Twenty-ninth Avenue substation in Spokane.



Interior of Little Falls Power Plant.

The Little Falls station, which was completed in 1910, is about 30 miles northwest of Spokane. This plant contains four units, each consisting of a 9000 h.p., I. P. Morris horizontal twin water wheel direct connected to a 5500 k.v.a., 4000 volt General Electric generator. The water wheels will develop a maximum of 11,000 h.p. each when operating under a 73



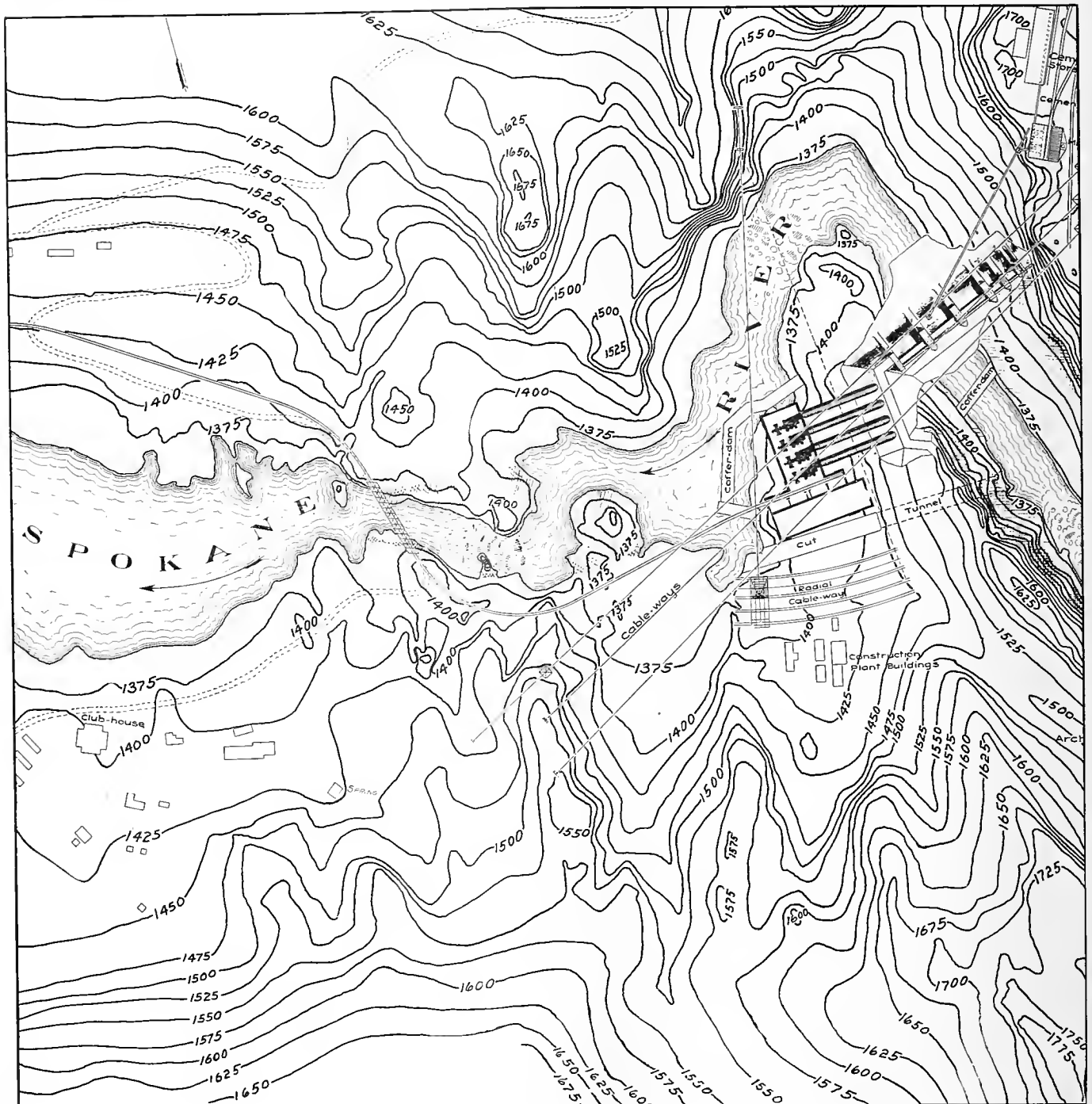
Steel Tower Line.

The tower line is 26.5 miles long, and is composed of steel towers of bolted angle iron construction, the average spacing being 650 ft. The conductors are of 270,000 cir. mil aluminum cable, hung from a

4 unit suspension type insulator with arcing rod and wooden clamp of the company's own design. Two $\frac{3}{8}$ in. steel cables are suspended on the peak of the tower and serve as ground wires. With the exception of this tower line, all high tension lines are of wooden pole construction.

about 250 ft. from the dam. This arrangement can be seen by referring to the map, which shows a general plan of the site and location of the dam and station.

The installation consists of four 13,900 k.v.a. generators direct connected to four 22,500 h.p. turbines.



Map of Long Lake Development.

Long Lake Development.

The Long Lake Development is situated on the Spokane River about 24 miles northwest of the city of Spokane. At this point the river makes a complete horseshoe bend and passes through a box canyon, the walls of which are of granite formation rising to a height of about 350 ft. above the water surface, making an ideal location for the highest spillway dam in existence, with the power station around the bend

This plant is also 19 miles south of Springdale, on the S. F. & N. Railway, a branch of the Great Northern Railway, from which point a standard gauge railroad, including a bridge of 172 ft. span, has been built to handle the 100,000 tons of material required for the construction of the plant.

Active construction work was commenced in October, 1910, but on account of cold weather during the winter months, little work was done during that

period, besides putting up construction buildings, bunk houses, etc., and installing the necessary machinery and equipping the temporary substation.

A 60,000 volt transmission line, $4\frac{1}{2}$ miles in length, was built from Little Falls Station, connecting with the temporary substation, in which three 650 kw. transformers were installed, and from which current was supplied to the various parts of the job at 2300 volts.

The camp consists of a general store, postoffice, dining room and cook house, 15 bunk houses, 75 four-room houses, hospital, cement laboratory, office building, club house, steam laundry, hotel, barber shop, etc. As Long Lake is 17 miles from the nearest station, it was deemed advisable to carry a complete line of groceries, dry goods, clothing, boots and shoes, goods being sold to workmen at Spokane prices.

The dining room and cook house are so arranged as to accommodate 250 men at one time. Eight of the bunk houses on the south side of the river are of the double deck type, and accommodate 25 men each. The balance are built on the north side of the river, and are used by such men as wish to board themselves. The 75 four room houses are used by the married men and their families.

The hospital is well equipped with the necessary beds and operating table, with a physician constantly in attendance.

The main room of the club house is 75x50 ft., with smaller rooms adjoining and containing billiard tables, piano, card tables, etc. A club manager is in charge whose duty is to look after the club and provide amusements, such as moving pictures, vaudeville, etc. Being a thorough athlete, he also takes great pride in organizing baseball, basket ball and tennis teams. The club is one of the best investments on the work, as it tends to keep the men more contented, especially during the rainy or cold periods.

In addition to this temporary camp, the nine permanent operators' cottages, and permanent school building were constructed at the beginning of the work. The cottages each contain six rooms, are strictly modern in every respect, having a complete set of plumbing, full basement and heating plant, and are arranged in a semi-circle 125 ft. apart, with lawn and shade trees and a fine orchard adjoining.

The school building, which has a seating capacity of 40 pupils, is also modern in every respect, being a plastered building with full basement which contains a hot air heating plant and toilets.

All the temporary buildings, as well as the permanent ones, are electrically lighted throughout and have sewer and water connections. The water is taken from a large spring, and is pumped into a 10,000 gal. tank on the side hill which gives 75 lb. pressure at all parts of the camp.

The construction plant consists of the usual necessary machine shop, blacksmith shop, engines, derricks, cableways, mixers, compressors, motors, steam shovel, sawmill, etc. The following probably deserve special mention:

Three Lidgerwood cableways of 1550 ft. span of $2\frac{1}{2}$ in. main cable, the carriages have a traveling speed of 1200 ft. per min., and a hoisting speed of 200 ft. per min., and are driven by 12x12 engines lo-

cated in the 60 ft. towers, maximum load being 12 tons.

One Lidgerwood cableway of 950 ft. span, with 80 ft. radial head tower, main cable 2 in.; carriages have same speed as above and are driven by 9x12 engines, maximum load 5 tons.

All cableways, hoisting engines, drills and steam shovel, etc., are driven by air furnished from 2 stage duplex compressors having a combined capacity of 5120 cu. ft. of free air per minute, each driven by a 200 h.p., 2300 volt a.c. motor. Two of these compressors are on the north side and two on the south side, all connected by a 6 in. pipe.

The concrete mixing plant which has a capacity of 2000 yds. per day, consists of two 2 yd. Hains mixers; three washing screens, each having a capacity of 50 cu. yds. per hour; three 36 in. rock conveyors having a speed of 50 ft. per min. and a capacity of 100 tons per hour; three 16 in. sand conveyors with a speed of 285 ft. per min. and a capacity of 80 tons per hour; one No. 4 Gates gyratory crusher with a capacity of 50 tons per hour; one rock conveyor from the crusher to the storage bins; one cement conveyor with a traveling speed of 75 ft. per min.; two sand bins with a total capacity of 360 yds.; and three gravel bins of 600 yds. capacity.

The gravel is brought to this plant from a pit $2\frac{1}{2}$ miles distant, from which point the railroad has been electrified. The equipment consists of motor car and 20 yd. Oliver air dump cars. The sand is hauled by dinkies and side dump cars from the sand pit about 500 ft. distant. The cement is conveyed from the storage shed, which has a capacity of 17,000 bbls., by means of the conveyor to the chutes of the mixer plant. The G-Y or gravity system was used in placing all the concrete, the location of the plant being ideal, as the bank on which the mixer was located was 400 ft. above the water surface.

The sawmill is a standard Curtis sawmill having a capacity of 25 M. feet b.m. per day, and is electrically driven.

The station building, which is "T" shaped, is a brick structure with concrete foundation and roof—open steel work, and steel sash, plastered walls with tile wainscot and floors. The brick are of exceptionally dark color, and were manufactured by the company at Chewelah where a plant was leased for this purpose.

The generator and wheel room is 75 ft. by 160 ft. and 65 ft. high, and the transformer switchboard and high tension rooms, which form the top of the "T," are 86 ft. by 207 ft., and 87 ft. high.

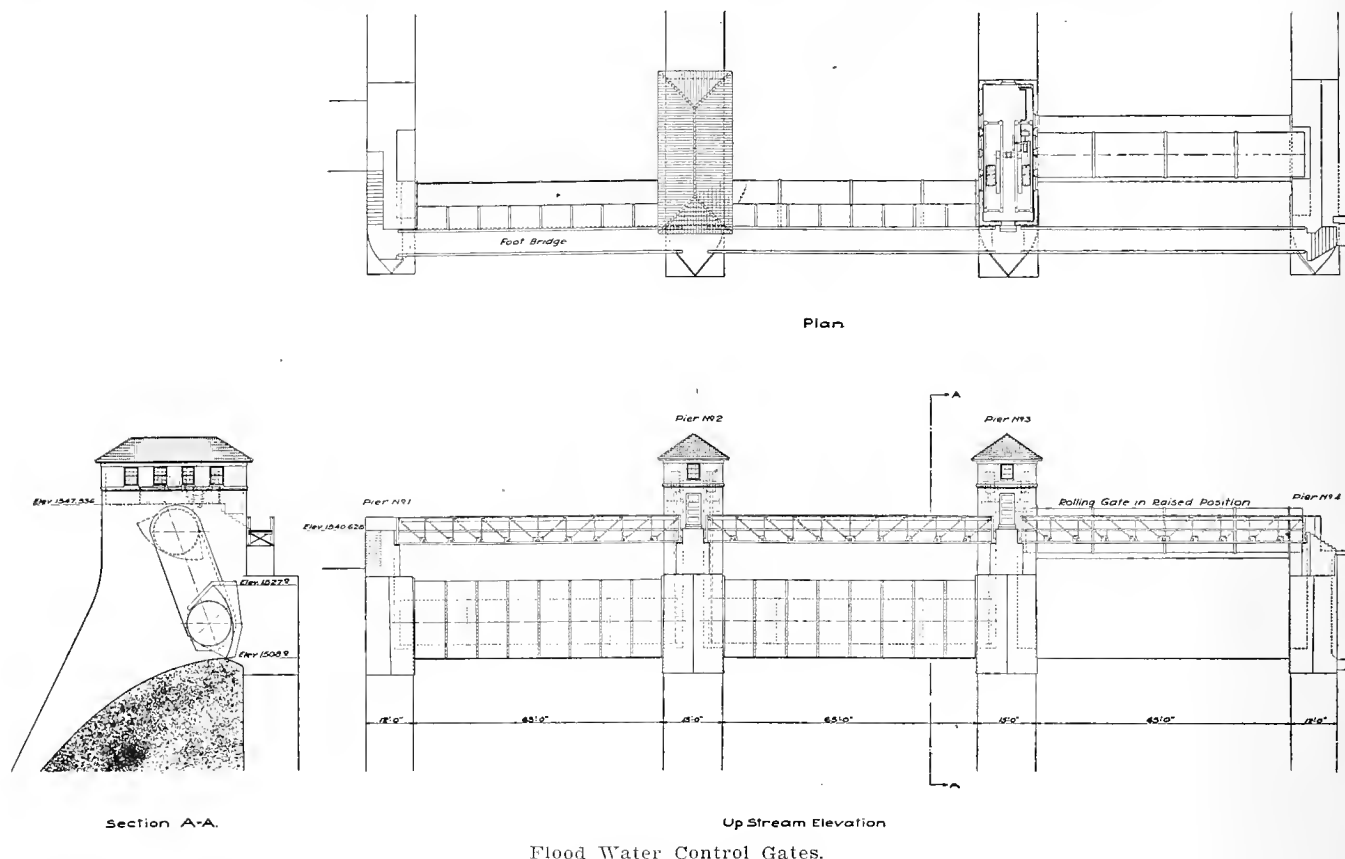
The transformers are placed in brick compartments 1 ft. above the main floor level, with openings toward the generator room. Immediately back of these are the machine shop and storage rooms; the latter also contain the oil treating plant.

The switchboard gallery is directly above the transformer compartments and gives the operator an unobstructed view of the entire generator and wheel room. On this gallery are placed, in addition to the switchboard, the low tension bus structure with its buses and switches and also field rheostats.

On the second floor, immediately above the machine shop, are the high tension oil switches, discon-

necting switches, and overhead, the high tension buses. Above this, on the third floor, are the lightning arresters, high tension current and potential transformers, line disconnecting switches with the choke coils in the open alcoves at line entrances.

which travel on a vertical 60 lb. rail concreted in the face of the dam. The wheel axles are mounted on bronze eccentrics which allow a forward movement of $\frac{3}{4}$ in. of the gate before raising. The main gate mechanism is driven by a 25 h.p. series motor so ar-



On the roof are placed the steel structures conveying the lines to the horn gaps through the roof bushings to the lightning arresters below.

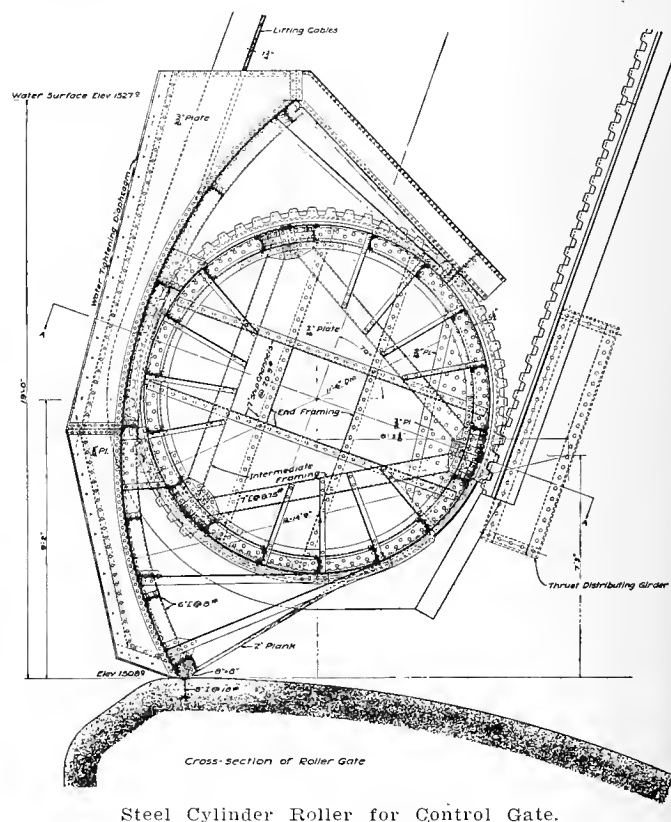
The storage battery is placed on a mezzanine floor in the machine shop. The generator and wheel room are served by a 90 ton Cleveland crane with 3-phase motors, and the high tension rooms by a 6000 lb. capacity elevator.

The railroad track enters the building in front of the transformer compartments, directly under the crane.

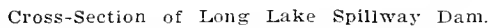
Special attention has been given to the ventilating system, air being supplied (when necessary) by three fans each having a capacity of 120,000 cu. ft. per min. at $1\frac{3}{4}$ oz. pressure. This air is taken from the outside between the penstocks and passes through tunnels under the floor into the generator pits. A monitor is provided along the entire length on one side of the building.

Special attention has been given to the drainage system on account of the possibility of extreme high water rising above the floor levels. Water tight doors have been provided. This system consists of two sumps, into which the various tunnels and pipe empty. These sumps may be drained by two 16 in. siphons supplied by an 18 in. pipe line running from the forebay under full station head. Three siphons can also be supplied through one of the turbines.

The head gates, which are 21x19 ft., are constructed I beams and plates, and operate on wheels



ranged that dynamic braking will come into play when lowering. The filler gate is 3x4 ft., and is operated



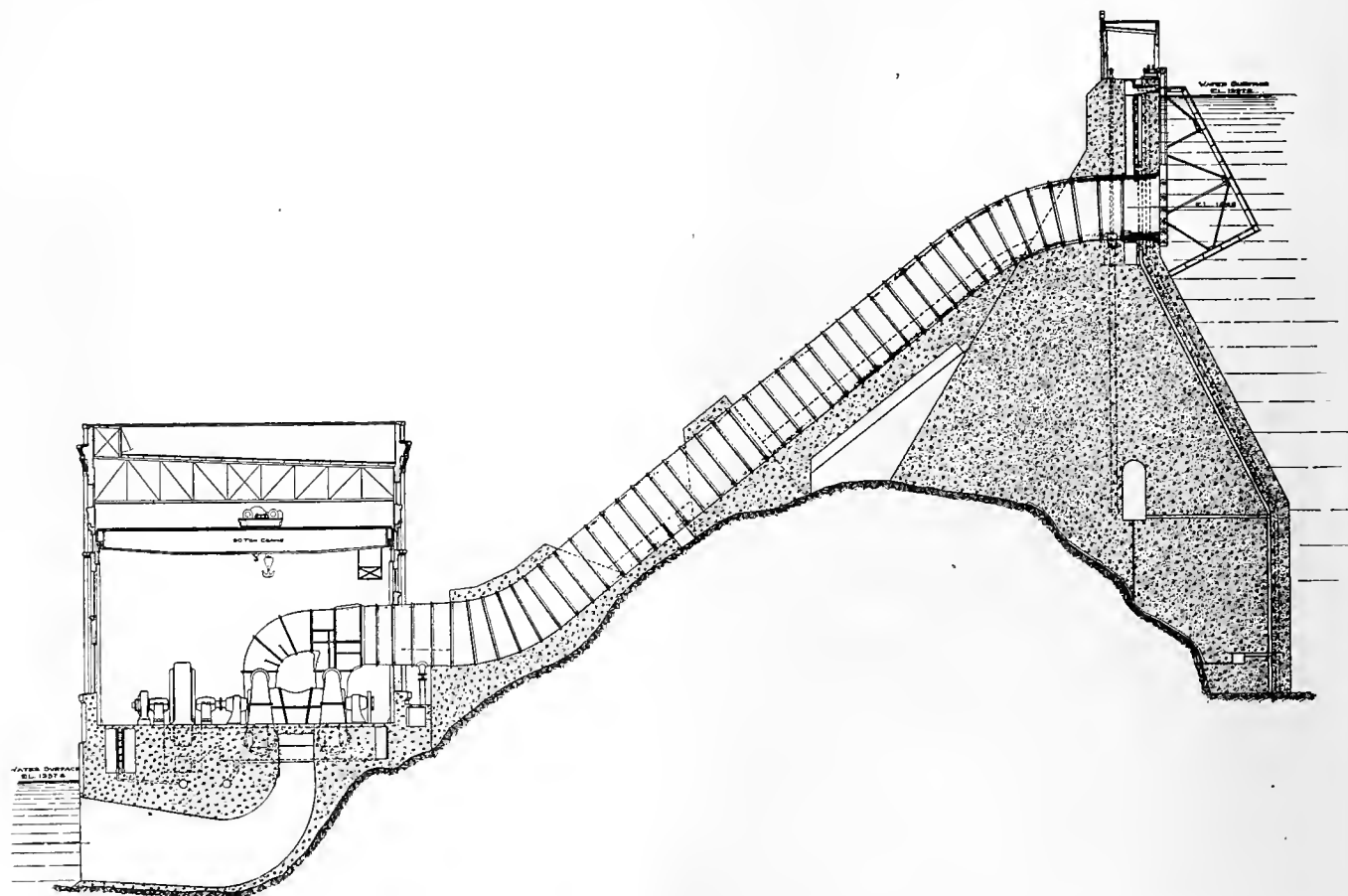
The leakage per gate will not exceed one cubic foot per second. This remarkable tightness is accomplished by the water seals, which consist of an oak timber placed on the lower end of the shield which rests on an "I" beam imbedded in the concrete, and steel diaphragms on the ends, to which is attached a 6x6 ft. oak timber which is forced (due to water pressure and flexibility of metal) against the flange of the "I" beams placed in the side of the piers. The total

weight of the three gates with their operating mechanism will be about 740,000 lbs. This style of gate was chosen on account of giving a large unobstructed opening, simplicity of construction, ease of operation and tightness of water seals.

Since it will not be necessary to use the total head at this plant for several years, the gates will not be installed until needed. They have, however, been designed in detail so that all necessary preparation, etc., for their erection has been made at this time.

The penstocks are 236 ft. long and 16 ft. in diameter at the upper end, tapering to 14 ft. 10 in. at the lower end. The plates vary in thickness from 15/16 in. at the lower end to 1/2 in. at the upper end, with 6x8x3/4 in. stiffener angles spaced 5 ft. apart the entire length. No relief valves or surge tanks are used.

The turbines, each of which has a capacity of 22,500 h.p., the largest output so far built, are of the double inflow horizontal Francis type manufactured by the I. P. Morris Co. Each unit consists of 83 in.



Cross-Section of Long Lake Power Development.

The three dams, consisting of the "spillway," "headgate" and "cut off or arch dam," are of cyclopean masonry construction, 25 per cent of which is large rock, and contain an aggregate of 275,000 cu. yds. The spillway dam is 208 ft. high from foundation to crest, 250 ft. thick at the base and 400 ft. long. The headgate dam is 100 ft. high, 100 ft. thick at the base, 18 ft. thick at the top, and is 240 ft. long. The arch or cut off dam is situated across a gulch about 900 ft. above the spillway dam. This dam is 100 ft. high, 50 ft. thick at the base, 5 ft. thick at the top, and is 540 ft. long, the radius of the upstream face being 170 ft.

The foundation of all these dams is solid rock. An elaborate and complete drainage system has been constructed, consisting of a net work of drains on the foundation, which are connected by pipes to the inspection and drainage tunnels, which will relieve any upward pressure other than that due to back water, that might exist.

Most of the excavation has been solid rock, total amounting to about 500,000 yds.

twin runners enclosed in cast iron volute casings and operate at a speed of 200 r.p.m., under a 168 ft. effective head with a guaranteed efficiency at 3/4 load of 85 per cent. According to data obtained from the test runner, an efficiency of 91 per cent is expected. The turbines are purchased subject to a bonus and penalty clause.

The governors are the I. P. Morris double floating lever arm oil pressure type, and operate under a pressure of 200 pounds and are guaranteed to operate the gates of the turbine at a speed variation of 1/2 of one per cent. The open oil system is used with by-pass unloading valve allowing the oil pump to operate under pressure only when oil is needed in the accumulator tank.

The oil pump is a 5 1/2 x 8 in. horizontal triplex direct connected to a 20 h.p., 220 volt, d.c. motor which is supplied with current from station d.c. service with floating storage battery. This allows free access to the rear end of the turbine, eliminates belt and clutch troubles and at the same time makes it possible to get the oil up to full pressure before a unit is started.

The oil systems are inter-connected, thus allowing the use of any pump for any turbine and being motor driven, any pump can be put in operation, although its turbine is not running.

The four generators, each of which has a normal rating of 13,900 k.v.a. at 4000 volts, are direct connected to the 22,500 h.p. turbines running at a speed of 200 r.p.m., and have been tested at 100 per cent overspeed for five minutes.

These generators are capable of operating continuously under a 25 per cent overload, at .90 per cent power factor when supplied with 60,000 cu. ft. of air per min. they can carry an additional load of 15 per cent, thus increasing the normal rating 40 per cent.

and passes through a Venturi meter with manometer with electrical low water alarm device.

Switchboard apparatus—Special effort was made to place the control of all electrical apparatus within easy reach of the switchboard operator. From his position at the switchboard he is able to read every switchboard instrument, and within a half dozen steps to control absolutely any electrical circuit in the station; he has a clear view of the generator room; in front of him are a bench with its control and selector switches, and mimic buses indicating the position of every high and low tension switch in the station and a vertical panel with instruments indicating the operation of each machine and line; at his left are the



Present Appearance of Long Lake Plant.

Temperature coils are laid in the armature slots in each phase, and are connected to indicators at the switchboard, giving the temperature of the armature windings at all times. The air will be supplied through tunnels running directly into the generator pit.

Each generator shaft is extended, on which is placed a 250 volt, 220 kw. exciter which is sufficient to excite two generators.

Transformers—Each generator is supplied with a bank of 3 single-phase, 6500 k.v.a., 63,600/110,000Y/4000 volt water cooled transformers. For the present these transformers will be delta connected and operated at 63,600 volts; later they will be delta star operated at 110,000 volts. The test efficiency is 99 per cent at three-quarter load and over.

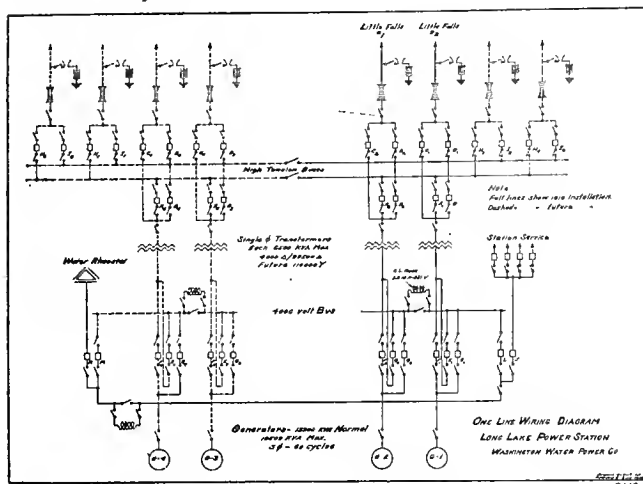
The 1½ in. cooling coils, of which there are three for each transformer, have their terminals brought out at the side of the tank 6 ft. above the floor line, allowing easy access to the packing glands. The water is supplied by a separate pipe running from the dam,

on the 650 miles of the company's transmission system; at his rear are the exciter, Tirrill regulators, station service and battery panels; at his right the relay and wattmeter panels. These are arranged about a rectangle 9x40 ft. A local telephone allows of communication between the wheel room, the switchboard floor, the headgate dams and the operators' cottages.

The station is designed with clearances for 110,000 volts, though the disconnecting switches and high tension buses are the only parts of the equipment so insulated at this time. All 4000 volt oil switches are motor operated Type H-6. All 70,000 volt oil switches are solenoid operated Type K-15. The arrangement of oil switches in the circuits is such as to give a liberal degree of flexibility in operation, facilitate rearrangement in case of a breakdown of one of the oil switches and allow of disconnecting any one of them for repairs, without shutting down any generator, emergency head gate controllers, and the telephone booth from which he can converse with any point

transformer or line. The circuits are shown in the one line diagram.

The synchronizing equipment is installed in duplicate and allows of synchronizing between generators, any generator to any line or between lines. Voltage regulation is accomplished by Tirrill regulators in connection with high voltage, high current cut out relays.



Wiring Diagram of Long Lake Station.

Ten per cent current limiting reactances were connected between sections of the 4,000 volt buses, and with the inherent reactance in the generator will limit to a safe amount the current flow between sections in case of a severe short circuit in one of them. No additional reactance is used between generators and step up transformers, as their total reactance was considered sufficient to take care of short circuits on the high tension side.

The auxiliary permanent equipment of the station includes a line of portable a.c. and d.c. instruments, oil testing transformer, oil treating outfit, and hot air type electric transformer dryer. A water rheostat, having a capacity equal to the maximum rating of one generator, is permanently installed and will be used in testing, and in cases of emergency in operating to quickly stop a unit if so desired.

The generator field rheostats, the exciter field rheostats and the turbine governors are all motor operated, thus placing their control conveniently in the hands of the switchboard operator.

All control circuits, head gate motors, governor oil pump motors, and all station lighting are supplied from a motor driven 100 kw., 3-wire, 125/250 volt, d.c. generator, with a 120 cell, 3-wire, storage battery floating on the bus, the latter being of sufficient size to take care of this class of service for 30 minutes, in case of trouble with the 100 kw. motor generator set.

Any exciter can also be connected to this bus, if desired.

Station heating is done electrically, the energy being supplied through a 900 k.v.a. bank of transformers at 220-440 volts. Each heater is 10 kw. capacity, and all were constructed in the company's shops.

All electrical equipment for this development was supplied by the General Electric Company. All the designs were made and the construction carried on by the engineering staff of the Washington Water Power Company.

A STUDY OF TRANSFORMER OILS.

BY G. O. WILSON.

(After a brief history of the use of oil as an insulating and cooling medium, statement is made of the properties of oil and the results are given of tests made by the author. This article is condensed from Mr. Wilson's thesis for a degree in the Department of Electrical Engineering at Leland Stanford Jr. University.—The Editor.)

The first patent covering the use of oil as an insulator in transformers was granted to Elihu Thompson, in May, 1887. The principal advantage which he claimed for the system was the "self-healing" property of the oil insulator, i. e., the fluid oil was supposed to flow into any place where the insulation had been broken down, and automatically and instantaneously repair the damage. This Utopian ideal of the inventor was soon found to be beyond the possibilities of a practical transformer; for when power was placed behind the voltage producing rupture the oil did not rush in and suppress the arc as it had suppressed the sparks of the inductor machine which Mr. Thompson first used as a source of high voltage for his tests.

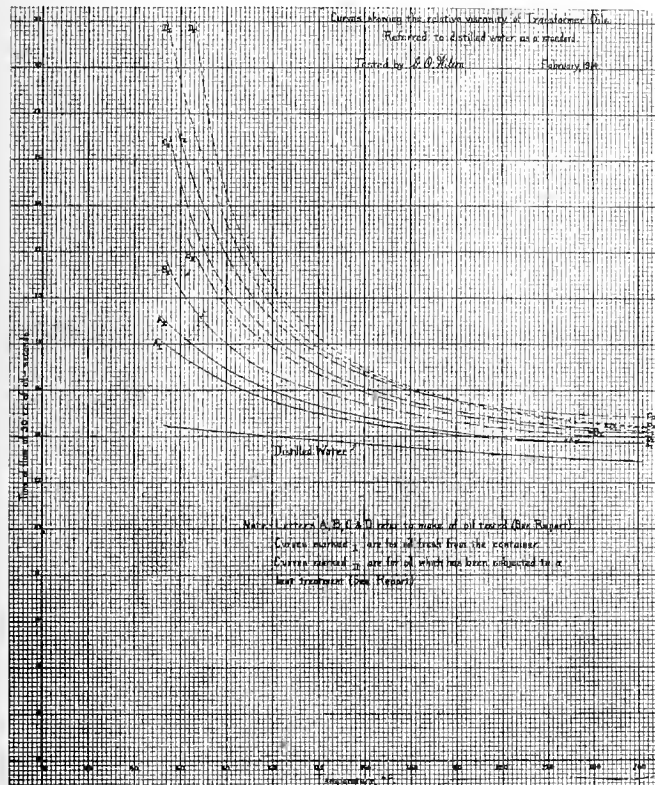
Nevertheless, when the General Electric Company produced their first commercial oil-insulated transformer in 1893, its chief claim to distinction was based on the self-healing properties of the oil insulation. It was claimed that the transformer would not break down until a pressure of 11,000 volts had been applied to it; and that after such breakdown, instead of being useless, it would stand, after a few moments, a working pressure of 5000 volts. The producers of this early transformer did not seem to appreciate the value of the oil as a cooling medium; they made no reference to such advantage in their advertisements of the apparatus, and it was not until the latter part of 1894 that the electrical trade seemed to discover this second role of oil.

It was, therefore, only about twenty years ago that a practical beginning was made in the use of oil as an insulating and cooling medium for transformers. At that time, and until very recent years, the oil used was a heavy, dark liquid, and no particular attention was paid to its physical or chemical characteristics. But the advent of the high voltage transformer of great capacity as an integral part of the great transmission networks has made necessary the securing of an insulating medium of the highest quality. Much work has been done, especially in Europe, to determine just what quality of oil will most satisfactorily meet the stringent requirements of present day practice.

An oil must be examined both physically and chemically. The most important physical tests are the determination of the relative viscosity, the dielectric strength, the quality of deterioration with use, the volatility, the specific gravity, and the temperatures at which the oil chills, flashes and burns. The chemical tests must be made to determine whether the oil contains moisture, sulphur, acid, alkali, or other foreign substance, which might prove deleterious to the apparatus in which it is used.

If the viscosity is so great that the oil cannot circulate freely through the coils, inner portions may become dangerously overheated, the insulation of the wires will deteriorate and the oil will be subject to rapid deposition of undersirable "sludge."

The efforts of the manufacturers to produce an oil which will be sufficiently fluid to perform this cooling duty well have often led into a new difficulty; for the less the viscosity of a pure refined mineral oil, the lower its **flash-point**, and herein lies the importance of examining any oil for its temperature of flashing and burning before accepting it as an insulating oil.



Curves Showing Relative Viscosity of Transformer Oils.

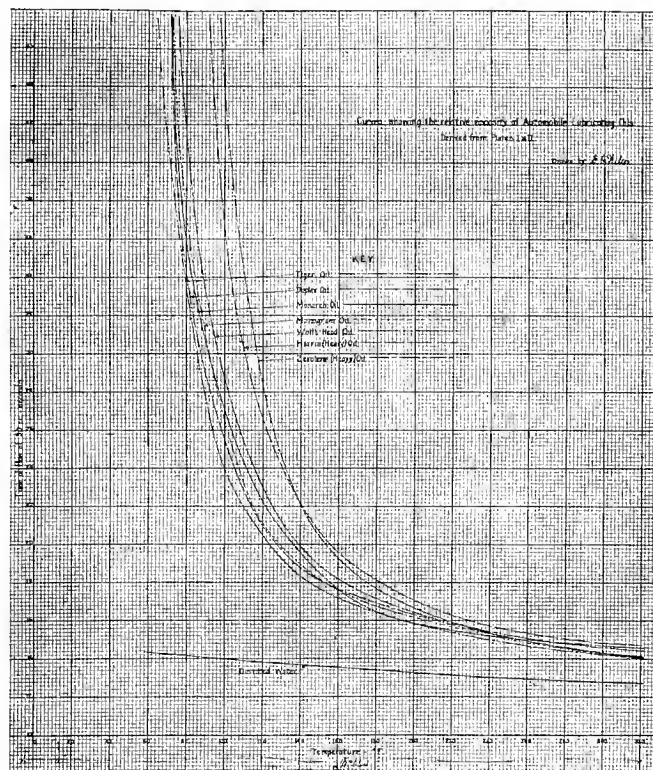
There is a wide range over which the flash-point of the oil may vary and still be safe for use in a transformer. It is the opinion of the writer that 133 degrees C. or 271 degrees F. is perfectly safe for any class of service, for this temperature is far above that at which any transformer would be allowed to operate, even under the most severe conditions of overload.

While a low viscosity is accompanied by the disadvantage of a low flash-point, there is some compensation in the fact that the **chill-point** is correspondingly lowered. The rapidly increasing use of out-door substation equipment makes this property of the oil of considerable importance. For in localities where the winter temperatures may fall well below zero, the danger of throwing full load onto a transformer which has been standing idle long enough to permit the oil to freeze may be considerable. Serious over-heating is liable to occur before the oil can thaw and resume its cooling duties; and the dielectric properties are more or less unreliable when the oil is in a frozen condition, upon freezing, for at least the one oil which he was testing.

The matter of **deterioration** of oil with continued use in a transformer is one which is attracting much attention. Although it may be due to the accumulation of dust in case of poor design or faulty location, the main cause of deterioration is the continued heat and electric stresses in the transformer. Many tests prove conclusively that oxygen is also an essential fac-

tor in the deterioration. The best design of large transformers would seem to be one in which all "breathing" due to changes of temperature is prevented.

Tests for **volatility** show whether too much oil will be lost by evaporation when used at a continuous, fairly high temperature in a transformer open to the



Curves Showing Relative Viscosity of Automobile Lubricating Oil.

air. The measurement of the specific gravity of the oil may be quickly and easily made with a Westphal balance or hydrometer. It affords a means of grading the oil as "light" or "heavy" and is of interest in conjunction with the study of the viscosity of the oil.

Dielectric strength may be expected to vary widely in different oils, or in different samples of the same oil, because of its startling dependence upon the presence of minute quantities of impurities that may have found their way into the test samples. Care must be exercised in having the details of each test identical, in order to get results on different oils which will be comparable.

If **moisture** is found to be present by tests, the next problem is to remove it. If very large quantities are present, the first thing to do is to allow as much as possible to settle out and be drawn off at the bottom; in this connection, there is an effect of viscosity which might be overlooked, and which is of importance in protecting a transformer from damage in the event of a leak in the water cooling system. Some of the more viscous oils will hold permanently in suspension enough water to ruin them, where the lighter oils might throw it down under the same conditions of operation.

For freeing the oil from the last trace of moisture, probably the best plan is to pass it through a blotter filter-press. If this is not available, the oil may be

heated to a moderate temperature, say 80 degrees C., in a vacuum for a number of hours; warm air may be bubbled through, or chemical dehydration by means of sodium, lime or other substance which reacts with water, may be employed. Of these three, the last is probably the most effective and the least harmful to the oil.

Sulphur has been found to be almost as harmful as water to the electrical qualities of the oil, reducing its dielectric strength and destroying the insulation. It should be as rigidly excluded as moisture from all electrical oils.

But no matter how carefully tests may be made for these qualities the final and conclusive test can only be that of **service**; the oil standing up best in the laboratory tests may not always be the best oil for every service to which it may be put. The wide divergence in the characteristics of the oils tested in the laboratory by the writer indicates clearly that a good guide to the most probable oil to select will be furnished by such tests, and a knowledge of the technique of oil handling will therefore be of the highest value to a transmission engineer.

The writer has examined three well known commercial transformer oils, Transil, Mineral Seal and High Flash. For interest of comparison, the General Electric Company's switch oil was submitted to a similar set of tests at the same time.

In order to show at a glance the results of the tests carried out, the following tabular arrangement is given:

Oil.	Transil.	High Flash.	Mineral Seal.	Switch.
Viscosity, Sec. at 70 deg. F..	19.1	22.1	16.9	26.0
Specific Gravity.....	0.8485	0.8570	0.8557	0.8670
Acid, per cent.....	None	None	None	None
Alkali, per cent.....	None	None	None	None
Sulphur, per cent.....	None	None	None.	None
Carbon, per cent.....	82.6	80.3	81.2	81.6
Chill Point, deg. F.....	16.3	19.3	-40	20.5
Flash Point, deg. F.....	325	354	285	372
Burning Point, deg. F.....	361	401	310	427
Dielectric Strength, Volts bet. spheres, .15 in. apart....	31,770	25,130	21,550	23,700

The curves derived from a study of the variation of viscosity with temperature are also illustrated herewith.

The **Ferris bill** for the development of water power on the public domain has passed the House of Representatives. The text of this bill was printed in full in this journal of April 18, 1914. It gives the Secretary of the Interior authority to make leases for a period of 50 years for development of such water power, the leases to terminate at that time and be taken over by the government at a fair valuation unless renewed.

Electric milkers on the Teel ranch, near Shafter, Kern, County, California, are being successfully used to milk sixty cows daily. The power bill runs from \$10 to \$13, as compared to \$180 wages of three expert milkers otherwise required. A 3 h.p. motor drives an air-compressor furnishing the suction. On this ranch water to irrigate 160 acres of alfalfa is electrically pumped, the cream separator is motor-driven, and all lighting is with electricity. Power is supplied by the San Joaquin Light & Power Company.

POWER OUTLOOK AT ARROW ROCK RESERVOIR.

At a meeting of water users of the Boise government reclamation project held near Caldwell, Idaho, a paper prepared by Supervising Engineer Weymouth discussing the question of the development and disposal of electrical power incident to the reclamation work at Arrow Rock and at the government diversion dam on the Boise River above Boise, was read. In this paper Mr. Weymouth points out some of the good and bad features of Federal development and submits facts and figures to the settlers on the Boise project. Mr. Weymouth's discussion of the power situation follows in part:

"All power development on reclamation projects is done under Section 5 of the act of Congress, approved April 16, 1906, (34 state 116) which is as follows:

"That whenever a development of power is necessary for the irrigation of lands under any project undertaken under the said reclamation act, or an opportunity is afforded for the development of power under and such project, the secretary of the interior is authorized to lease for a period not exceeding 10 years giving preference to municipal purposes, and surplus power or power privilege, and the moneys derived from such leases shall be covered into the reclamation fund and be placed to the credit of the project from which such power is derived. Provided, that no lease shall be made of such surplus power or power privilege as will impair the efficiency of the irrigation project.

"When the construction of the Arrow Rock dam was decided upon it was found that the local power companies did not have sufficient surplus capacity to provide for the needs for power for construction purposes at Arrow Rock, consequently there was constructed the power plant located at the diversion dam for this purpose. This plant is built in a permanent manner so that after the construction of the Arrow Rock dam is completed it can be utilized in any manner under the law that will best serve the interests of the Boise project.

"This plant exclusive of the transmission lines leading from it to Arrow Rock, cost \$168,000 and has a capacity of 3000 h.p. when the river is carrying over 1300 second-feet of water. The possible power output of this plant decreases with the flow in the river until a minimum of about 1100 h.p. is reached during the extreme low water period of the river.

"To the end of July nearly 8,000,000 kilowatt hours of power have been used in connection with construction work at Arrow Rock and nearly 5,400,000 kilowatt hours have been sold to local companies, since their present installation is not sufficient to supply their present requirements. This power sold has brought a total revenue to the credit of the project of nearly \$22,000. These sales have recently amounted to between \$2000 and \$3000 per month.

"After the Arrow Rock dam is completed the best use for the project of this plant will be to sell for all-year-around purposes such power as can be developed throughout the year and this all-year-around power, amounting to about 1100 h.p. should command a good price. The additional power capacity of the plant over and above this 11,000 h.p. reaches a maximum of about 1800 h.p. at the height of the irrigation

season and it is thought that it will be necessary to sell this additional power at a lower rate as it will only be available during the summer months and it is probable that the best use and perhaps the only use can be obtained for this power will be pumping for irrigation.

"Coming to the matter of developing power at Arrow Rock I find that the popular belief is that Arrow Rock must be an excellent power site—that a large amount of power can be developed there at low cost.

"Some power can be developed at that point at a reasonable cost; I refer now to the power that can be developed throughout the year, and this amounts to about 4000 h.p. A large amount of power can be developed during the irrigation season but at a rather high unit cost for construction plant, much higher, for instance, per horsepower than many plants that have been built in this state along the Snake River. It would be possible to develop at Arrow Rock for a short time during the height of the irrigation season, or when the reservoir is practically full, as much as 75,000 h.p., but it would not be feasible to construct a power plant that could only be used for a few months or weeks during the year.

"The construction cost per horsepower at Arrow Rock for large development must necessarily be expensive. Besides the construction cost it is necessary to take into consideration the yearly cost of keeping the plant up in a first class condition and some of these items are as follows: Depreciation on a well built plant will amount in a year to about 4 per cent, interest on investment should be figured at about 6 per cent, insurance on plant about 1 per cent, taxes at about 2 per cent or a total of these items of $13\frac{1}{2}$ per cent. If a power plant cost \$100 per horsepower and an amount of \$13.50 per horsepower per year will be required to take care of the items above mentioned.

"To this amount must be added the cost of maintenance and operation of the plant, which would be about \$2 to \$4 per horsepower per year, depending upon the size of the plant. In addition to these charges will be the cost of transmission lines, transformer stations, etc.

"Under the conditions prevailing at Arrow Rock, taking into account the requirements for irrigation water, which are paramount, about 4000 h.p. can be developed throughout the year except for about ten or fifteen days the latter part of October of extreme low water years, when the output would drop to about 3000 h.p. This amount of power can be developed at that point at a reasonable cost and pipes for power purposes to the above extent have already been installed in the dam to make possible such power development if it is found feasible and money can be secured for it in the future.

"If a plant is built to develop about this amount of power at Arrow Rock, such a plant would tie in well with the plant at diversion dam, as the time of minimum output for each plant is not the same, so the two working together can supplement each other; that is, each can help the other throughout its weakest period. These two plants working together could turn out about 5200 h.p. throughout the year, which

would make good returns for the project, provided a good market can be found for all-the-year-around power at reasonable rates. To sum up, a commercial power plant about 4000 h.p. built at Arrow Rock and tied in with the diversion dam power plant would be a good investment and asset for the project if an all-year-around market can be found for the power at reasonable commercial rates.

"It will be possible to develop a large amount of power in addition to the above amount named during the summer months, when there is a large amount of water passing through the dam for irrigation purposes but it is doubtful if a market can be obtained for this power which would only be available during the irrigation season, at a rate which would warrant investment in such a plant. In other words, it is possible to develop a commercial power plant at Arrow Rock if a market can be obtained at commercial rates for its power and it is probable that a market will come at some time in the future, but it is doubtful if a market can be obtained for the summer power at rates which would make a good investment."

Panama Canal new radio stations are being constructed at Colon and Balboa to supplant the present stations in communicating with ships of the Army and Navy and commercial vessels within a normal operating radius of 500 miles from the canal. Their service will be similar to that of the present stations, but will exceed in area the present 300-mile daytime reach of the present station at Colon, and the 200-mile daytime range of the Balboa station. The Colon station will be equipped with two interchangeable sets, the smaller to be used regularly for local work, and the larger to be switched in for farther communication when desired. The large set will be capable of communicating as far as Key West, and may thus be substituted for the Darien high power station in communicating with the United States, if the need arises. The larger set at Colon will use the equipment of the present station. The new stations at the ends of the Canal will be practically identical in form, except that the Colon station will have a slightly larger power house, to accommodate the two sets of sending apparatus. At each the antennae will be stretched between two 300-foot steel towers, 600 feet apart. Each tower will be self-supporting, resting on three footings, arranged in an equilateral triangle, 60 feet on the side. The footings, which have been completed, with anchor girders, are blocks of concrete, nine feet square in plan, resting on piles driven through fill to rock. At Colon, where the piling is below sea level, timber piles were used, but at Balboa, on account of higher elevation, reinforced concrete piles were driven. Both stations will receive power from the Canal transisthmian electric system, developing it through transformers to the potential required for operation. They will use a different system of radiation from that proposed for the Darien station, so that there will be no interference. They will conform to the international convention, using a wave length of 600 meters for communication with commercial ships, and from 1000 to 2500 meters for naval work.

ELECTRIC DISTRIBUTION

STANDARDS AT SAN DIEGO.

BY L. M. KLAUBER.

D. Overhead Construction.

[Continued.]

(The fourth installment of Mr. Klauber's series of articles regarding distribution standards for central stations, deals with crossing clearances. Special attention is devoted to the design of the 11,000 volt crossing to meet the N. E. L. A. specification for Overhead Crossings of Electric Light and Power Lines with such amendments and additions as are required by the California laws.—The Editor.)

D. 40, 1, 2, 3—Crossing Clearances.

Rules governing the crossing wire lines with railroads or other wire lines.

Wires of the same lead—This order does not apply to clearances between wires of the same lead. It is effective where leads cross or intersect.

Sidewalks are not considered as part of street or public highway. Clearances specified refer to that portion of the street between curbs.

Lines on streets—Where a line runs along a street or alley it is not necessary to clear this street or alley by the distances given; the clearances specified refer to those streets or alleys which the line crosses.

Low voltage wires include secondary power and light under 600 volts, except trolleys and trolley feeders.

Sags—Clearances specified must obtain under the most unfavorable conditions of temperature and loading, therefore, a sufficient margin should be allowed in all cases, especially where the wires are likely to sag in hot weather.

Buck arms—Where buck arms are used, the clearance from the main arm to the buck arm must be at least as

great as the separation of the wires on the main line arm, and the next lower arm should be dropped an equal distance. See D. 30, 19.

Railroad crossings—In crossing railroads or street railroads with any of our lines (except service drops) the following specifications apply:

- Span not to exceed 200 feet.
- Poles not less than 8 in. top.
- Double arm all lines.
- Guy poles to prevent possibility of wires sagging.
- 11,000 volt crossings are specially constructed, as shown in Sheet D. 41, 1.
- Poles must clear horizontally from the center line of railroads 8 feet.

Wire Clearances.

- Low voltage wires must clear—
 - Over rails of railroads or street railroads, not less than..... 25 ft.
 - Over streets, alleys or public highways, not less than..... 20 ft.
 - Over telephone, telegraph or signal wires, not less than..... 2 ft.
 - Over or under other low voltage wires, not less than..... 2 ft.
 - Over trolleys or trolley feeders, not less than..... 4 ft.
 - Over or under primaries and arcs, not less than..... 4 ft.
 - Under 11,000 volt lines, not less than..... 4 ft.
 - Over buildings or other structures, not less than..... 4 ft.
- Secondary drops must clear—
 - Over streets, alleys or public highways, not less than..... 20 ft.

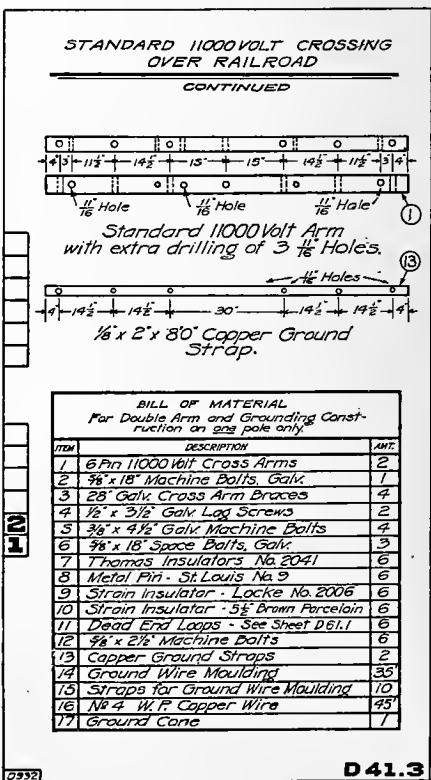
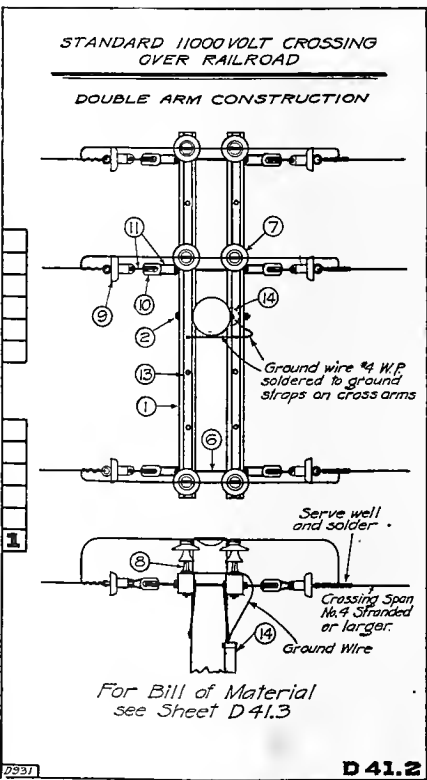
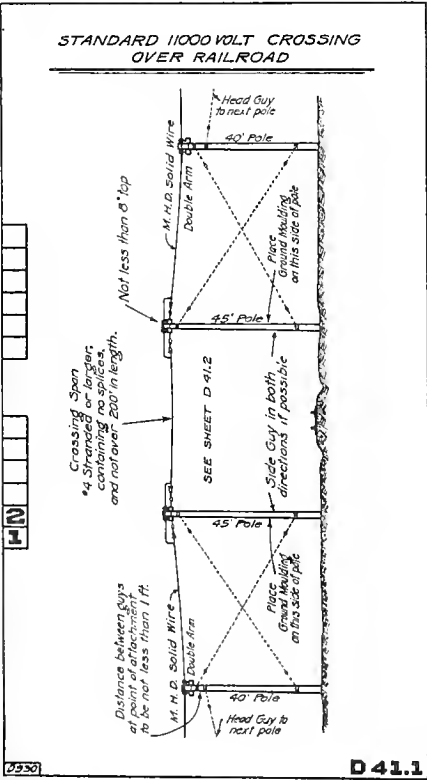
- Over or under telephone, telegraph or signal wires, not less than..... 2 ft.
- Over or under low voltage wires, not less than..... 2 ft.
- Over trolleys, not less than..... 4 ft.
- Over or under trolley feeders, not less than..... 4 ft.
- Over or under primaries or arcs, not less than..... 4 ft.
- Over buildings or other structures, not less than..... 4 ft.
- Under 11,000 volt lines, not less than..... 4 ft.

Primaries and arcs must clear—

- Over rails of railroads or street railroads, not less than..... 28 ft.
- Over streets, alleys or public highways, not less than..... 24 ft.
- Over telephone, telegraph or signal wires, not less than..... 4 ft.
- Over or under low voltage wires, not less than..... 4 ft.
- Over trolleys, not less than..... 4 ft.
- Over or under other primaries or arcs, not less than..... 6 ft.
- Over or under 11,000 volt lines, not less than..... 6 ft.
- Over buildings or other structures, not less than..... 6 ft.

11000 volt lines must clear—

- Over rails of railroads or street railroads, not less than..... 28 ft.
- Over streets, alleys or public highways, not less than..... 24 ft.
- Over telephone, telegraph or signal wires, not less than..... 6 ft.
- Over or under low voltage wires, not less than..... 4 ft.
- Over or under arcs or primaries, not less than..... 6 ft.
- Over or under other 11,000 volt lines, not less than..... 6 ft.
- Over buildings or other structures, not less than..... 6 ft.



EFFICIENT POWER PLANT MANAGEMENT

CORRESPONDENCE FILING CLASSIFICATION.

[Continued.]

(This series of articles represents the system used by the Pacific Power & Light Company of Portland, Oregon, and is believed to be the first practical adaptation of the Dewey decimal system for the use of public service corporations.—The Editor.)

600—Railways and Highways.

602—Design and Construction Details—Specifications—Contracts—Bids.

(Note:—File under the specific equipment or thing involved, if possible.)

610—Proposed Extensions.

- 610.1—Cost Analysis and Unit Costs.
- 610.2—Valuations—Preliminary Reports.
- 610.3—Investigations.
- 610.4—Locations.
- 610.5—Program of Work.
- 611.—Tests and Inspection.

(Note:—File under specific equipment or thing involved, if possible.)

620—Roadway and Roadway Structures.

- 621—Grading and Ballasting.
- 622—Bridges and Trestles.
- 623—Tunnels and Culverts.
- 624—Crossings.
 - 624.1—Highways with Railways.
 - 624.2—Highways with Electric Circuits and Telephone Lines.
 - 624.3—Railways with Electric Circuits and Telephone Lines.
 - 624.4—Railways with Other Railways.
 - 624.5—Electric Circuits with Telephone Lines.

625—Track.

- 625.1—Ties.
- 625.2—Rails—Switches—Other Track Specialties.
- 625.3—Bonds.

626—Paving and Surfacing.

630—Overhead Construction.

640—Rolling Stock.

- 641—Locomotives and Tenders (Electric or steam).
- 642—Passenger Cars.
- 643—Freight Cars.
- 644—Work, Repair and Material Cars.

650—Operating Data—Supplies—Methods.

- 651—Operating Data—Station Records.
- 652—Operating Methods.
 - 652.1—Rules and Regulations.
- 659—Troubles and Characteristics of Operation.

(Note:—File under specific equipment or thing involved, if possible.)

660—Traffic.

- 661—Passenger Traffic.
 - 661.1—Passes.
 - 661.2—Mileage Books.
- 662—Freight.
- 663—Baggage.
- 664—Mail.
- 665—Express.

700—Material and Supplies.

701—Specifications.

(Note:—In each case file under the specific equipment or thing involved, if possible.)

702—Scrap.

703—Orders and Requisitions for Material — Credit Memos—Memos of Transfer.

705—Shipment of Materials.

- 705.1—Transportation Rates.

705.2—Routing—Shipping Instructions.

705.3—Tracing.

705.4—Records of Shipments.

705.41—Statement Uncompleted Orders.

705.5—Receipt of Materials.

706—Shortages—Overages—Damaged Goods.

710—Structural Materials.

711—Masonry.

711.1—Stone.

711.2—Concrete and Ingredients.

711.21—Cement.

711.211—Tests and Inspection of Cement.

711.22—Sand.

711.221—Tests and Inspection of Sand.

711.23—Gravel—Crushed Rock.

711.231—Tests and Inspection of Gravel—Crushed Rock.

711.26—Waterproofing of Concrete.

711.3—Brick—Tile—Ceramic Products.

711.31—Brick and Fire Clay.

711.32—Partition Tile & Terra Cotta.

711.33—Clay Sewer Pipe and Drain Tile.

711.39—Other Ceramic Products.

711.4—Mortars and Plasters.

711.41—Lime.

711.42—Patented Cements.

711.45—Proportions and Ingredients of Mortars and Plasters.

712—Timber Work and Woods.

(If wood is for use as fuel, file under the 731.3 series.)

712.1—Common Lumber.

712.5—Hard Woods.

713—Steel and Metal Work.

713.1—Structural Steel and Plate Work.

713.11—Reinforcing Steel.

713.2—Ornamental Iron.

713.3—Sheet Metal.

714—Roofing Materials.

714.1—Shingles.

714.11—Wood Shingles.

714.12—Slate Shingles.

714.13—Asbestos Shingles.

714.2—Roofing Tile.

714.3—Corrugated Roofings.

714.31—Corrugated Iron, Painted and Galvanized.

714.32—Asbestos Protected Metal.

714.4—Felts—"Ready Roofing" and Accessories.

714.5—Tar and Gravel Roofing.

714.9—Other Roofings.

717—Plumbing, Heating and Ventilating Apparatus (For Piping, see 742.)

718—Finishing Materials.

718.1—Paints—Oils—Varnishes—Stains.

718.2—Builders' Hardware.

719—Other Structural Material.

719.1—Glass.

[To be concluded.]

Photographing blueprints can be accomplished by means of panchromatic plates and a deep red ray filter, which will absorb the blue.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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The city of Seattle, Wash., is apparently realizing the advantage of controlled monopolistic as compared with competitive public utility service, and certain members of the council are now seeking to place the city lighting plant under especial protection by endeavoring to find ways and means of preventing competition from the steam-heating plant of the local lighting company.

When a municipality enters into utility service competition with an existing private corporation the circumstance is invariably described as a commendable campaign to secure lower rates for the community than were afforded under former conditions, but when the war is carried right into the camp of the municipal ownership hosts, a resolution may be introduced into the council asking that the corporation counsel advise as to what legal steps may be taken, "to stop a system of hold-up and warfare upon the city plant."

The city is seemingly the first to recognize the absurdity of the situation when the competitive conditions for any reason are made too uncomfortable. The climax has been reached through the alleged refusal of the lighting company to supply steam-heat service to consumers unless they agree to purchase their electrical energy requirements from the company and agree to compel their tenants of the same building to do likewise.

This journal holds no brief for either the municipality or the private corporation, but there are certain conditions surrounding the supply of central station steam-heat which are worth consideration and from which important deductions bearing upon this situation may be made.

Central station steam-heat, though usually supplied by a utility company, can hardly be termed a utility service in the generally accepted sense of that term.

Central station steam-heat service is considered advantageous rather than of itself profitable. Its use is limited, but it is of value as an aid in securing light and power business, otherwise difficult to obtain, through removing the need for generating steam for any purpose, in this way removing also the possible installation of isolated plants. It may thus be considered part of a composite service, the use of which permits the central station to offer lower all-round rates due to the use of a waste product.

Assuming that this steam-heat business is unprofitable, it is questionable whether public service commissions would permit the continuance of a condition permitting a non-profitable service to be supplied at the expense of those using a profitable service supplied by the same company. But it must also be remembered that the consumer using this additional service has considerably lessened his cost to serve; and as so-called discriminating rates are frowned upon and in any case difficult of explication, the central station can only, in self preservation, occasionally give the steam-heat service at less than apparent cost.

There is no valid reason why a company should not reserve the right to supply steam-heat service

only to its electric light and power customers. This view will meet with more ready agreement when it is remembered that the use of central station steam-heat is not only limited to a comparatively small area but to a limited number of customers, depending upon the exhaust steam available during those periods when steam heat is required.

There are those who think that the company is using the steam-heat service as a club to compel the use of other services also, but this is not so. From the service standpoint, the greater the number of utilities under the same administration the greater the advantage. To the customer it may mean light, heat and power bills from the one concern. This simplifies bookkeeping. To the central station company it is admittedly easier to secure business when all services can be offered at the same time.

In competitive areas the sales advantage is entirely with the company having these several or more utility services, but it is so because of the advantages it offers to the customer. Certainly the central station company is entitled to first see that all its own customers are provided with the by-product of its plant,—steam-heat.

Poets have written of the battle between light and darkness, but to the electrical industry this situation contains more of profit than poetry. September marks the opening of another Fall lighting campaign. Vacations are over, business is nearer normal, and merchants are all looking toward coping with the final spurt which always winds up the year's business.

The electrical manufacturer has done his part, and this year especially so, in providing new equipment and facilities for the lighting branch of the business. Apart from the new lighting fixtures with their opportunity for increased business, there is the advantage of the general reduction in the price of Mazda lamps during the past year. Furthermore the new nitrogen-filled lamps are proving the season's novelty.

The war with waste is giving place to a war with wasted opportunities for producing the artistic and effective in lighting. Co-operation must obtain!

The fight which the contractor makes is the key to success for the whole industry. It is useless to complain of hard times and a dearth of business if no attempt is made to get out of the rut. There is no possible chance of holding on to custom and the past with one hand, and with the other trying to reach forward and grasp the new. The gulf is too great. The business depression demands that custom be forgotten and new methods tried out. This is your only reasonable expectation of success in the coming campaign. Do your part!

In this connection it is as well to remember that the technical press and certain manufacturers have supplied much technical and sales data as auxiliaries to your own effort. Use them! The printed page has of itself no virtue, nor has its possession. It is of value only as it is read and understood. The men who write those pages do not profess to know everything and solicit your ideas, but you will undoubtedly

find much of profit in their literature. Take time to look it over, for it will probably dispel the blues of business depression by showing you the way out.

Central stations must also do their part. A good lighting expert is an asset, for the item of his salary is insignificant compared with the amount of increased business and the service satisfaction which his specialized work secures. This is an assistance variably appreciated by the contractor also, who may then be expected to co-operate even more closely with the central station.

"Co-operation and Effectiveness in Lighting," should be the lighting campaign slogan this fall. General reduction in costs has made a bare efficiency of less importance. Results now count, for they are not necessarily costly no matter what may be desired. It should be remembered that load increase means an all-round business increase. Invention is making economy alone of non-effect. So much so that it will be better far this fall to cultivate effectiveness in lighting and to co-operate.

Following the thought that one tree-planted boulevard does not make a forest, it may be affirmed that even while some men do specialize, this is not necessarily an age of specialization. It even is questionable whether extreme specialization should be encouraged.

Many are today fearful because the privilege of concentrating upon one line of employment is denied them. Actually to be a "specialist" as generally understood, is not for all men a matter of prime importance. Provided you are thorough in all things, there is no need to fear the outcome of endeavor.

The man well-founded in fundamentals is worth more to himself and to society than the man who knows only one thing. The practical man is worth more than the man with a tremendous fund of specialized knowledge, but who lacks the opportunity or power to put it into practice.

To have a destination and the ability to arrive is important. To have both is to be practical. A practical man is one who can get results. Result-getting depends upon action, and action may often solve difficulties which according to every rule and practice and therefore in contemplation, appear insuperable.

Those who make a fetish of specialization forget that specialization makes for limitation, isolation, and a narrower horizon and outlook. Specialization to the average man means following the path of least resistance.

Many presidents knew not their destiny until they had arrived and their ability to hold down a one-man-in-ninety-million job was not because they had specialized on a course in White House administration but because they had obeyed the scriptural injunction and had been thorough in everything to hand. And history records that this often consisted in being thorough in the execution of many so-called menial tasks.

Careful attention to detail begets a power which proves superior to circumstances and which makes for progress and perfection of accomplishment in all things. A specialist can do no more. Be thorough.

The Fall Lighting Campaign

Thoroughness vs. Specialization

PERSONALS

F. H. Whipple, machinery contractor of Visalia, is at San Francisco.

W. A. Daggett has joined the sales force of the Aylsworth Agencies Company of San Francisco.

R. E. Frickey, superintendent Northern California Power Company, at Redding, Cal., is visiting San Francisco on business.

A. Kahn, purchasing agent of the Pacific States Electric Company, San Francisco, is on a trip to Seattle and the Northwest.

H. R. Williams, manager of the Stevens County Light & Power Company of Colville, Wash., was at Spokane during the past week.

Ray Simonds, manager the Simonds Machine Company of San Francisco, has returned from a two months' stay in Honolulu.

T. H. Nelms of the sales department, Pacific Electric Company, San Francisco, has left for a trip through Mendocino County.

H. D. Cranston, formerly in the foreign department of the General Electric at Schenectady, left last Monday for the Philippine Islands.

Miles F. Steel, salesman with the Benjamin Electric Manufacturing Company, is making a business trip throughout the Pacific Northwest.

Carl E. Heise, district manager Westinghouse Electric & Manufacturing Company at San Francisco, left for the East on a business trip this week.

G. W. Hubbard, municipal wiring inspector South Vancouver, B. C., as sergeant major of the Sixth Royal Irish Fusiliers, is on active home service.

W. S. Heger, manager of the San Francisco office of the Busch-Sulzer Diesel Engine Company, has returned from an extended trip through the Western states.

D. F. Fearing, western sales representative of the National Carbon Works of General Electric Company, Cleveland, Ohio, was at Vancouver, B. C., during the past week.

H. J. Mitchell, northwest representative of the Edison Storage Battery Company, visited the Canadian cities of Victoria and Vancouver, B. C., during the past week.

Geo. C. Holberton, manager of the San Francisco Gas & Electric Company, left for the East during the past week to attend the annual meeting of the Edison Illuminating Companies.

J. W. Cook, electrical inspector, city electrical department, Vancouver, B. C., has proceeded to Europe with the Vancouver contingent of the Sixth Duke of Connaught's Own Regiment.

Tadahiko Ayai, commercial manager Tokyo Electric Company, Ltd., who has been traveling throughout the United States, visiting factories and studying the commercial lighting situation, has left for Japan on the Manchuria.

F. I. Woltz has resigned as commercial engineer with the Great Shoshone & Twin Falls Water Power Company of Twin Falls, Idaho, to accept a similar position with the Union Gas & Electric Company of Cincinnati, Ohio.

L. G. Copeman, electrical engineer of the Copeman Electric Stove Company of Flint, Mich., who is making a trip throughout the West in the interests of his company, spent a few days in Los Angeles last week, exhibiting his company's latest products.

George H. Halse, secretary-treasurer of the British Columbia Telephone Company, is making an inspection trip over the Vancouver Island section of the company's system. This will probably be his last opportunity this season for reviewing the work done during the year.

Ralph Modjeski, consulting engineer of New York, Chicago and Portland, will visit Vancouver, B. C., during the early part of September in order to view the site of the proposed bridge to be erected across the Second Narrows by the Burrard Inlet, Tunnel & Bridge Company, before giving his final decision as to the plans submitted to him for adjudication.

W. R. Alberger, representing the Halsey interests, has succeeded **A. W. McLimont** as general manager of the San Francisco-Oakland Terminal Railways Company, whose expected financial rejuvenation has been halted by the European war. **N. S. Sliter** succeeds **W. E. Hendley** as chief of the efficiency department, and **H. P. Bell** takes the place of **L. B. Cramer** as electrical engineer.

W. C. Morris of Tacoma, Wash., is manager of the new gas company formed to supply Auburn, Wash., and vicinity and called the Auburn Gas Company. Work has been commenced. The holder will be fifty feet in diameter and 25 ft. deep. Cost of the plant will be between \$70,000 and \$80,000 and it is expected that service will commence within 90 days.

R. H. Sperling, left last week for London, England, accompanied by Mrs. Sperling. Mr. Sperling was formerly general manager of the British Columbia Electric Railway Company, Ltd., at Vancouver, B. C., and leaves to take up permanent residence in London in which city the head office of the company is situated. Mr. Sperling has been appointed assistant to the chairman of the board of directors, as previously noted in these columns.

A. H. Halloran, managing editor of this journal, is making a trip throughout the Pacific Northwest, in the course of which he will attend the joint convention at Spokane, making formal presentation of the International Electric Congress before the Pacific Coast meeting of the American Institute of Electrical Engineers, and of the 1915 meeting of the National Electric Light Association before the Northwest Electric Light & Power Association. He will also give an illustrated lecture on the Panama-Pacific International Exposition at a joint meeting of the two organizations.

MEETING NOTICES.

Engineers' Club of San Francisco.

At the regular semi-monthly luncheon of the Engineers' Club of San Francisco, on September 2, Mr. R. B. Wolverton, U. S. radio inspector, gave an interesting talk on "The Wireless and the War."

Jovian Electrical League of Southern California.

The league will open its winter sessions on Wednesday, September 16th, with one of its characteristically joyous get-together luncheons at Christopher's. Chairman Colkitt and Senator Pieper have prepared a "tremendous" program, to use their own expression. F. F. Foster will be chairman of the day.

Alameda County Electric Development League.

The regular monthly meeting of the Alameda County Electric Development League was held Saturday afternoon, August 29, at the Saddle Rock Cafe in Oakland, California. "The Contracting Business as I See It" was presented in an interesting manner by H. W. Kimball, others present adding their quota to the ensuing discussion.

Electrical Development and Jovian League.

The Electrical Development and Jovian League of San Francisco held its first meeting of the fall term Tuesday, September 1, at an uptown cafe. The gathering—the initial one after a vacation period of two months—was most enthusiastic, and presided over by the new officers elected just prior to the vacation period. President, C. E. Heise, sales manager of Westinghouse Electric & Manufacturing Company; vice-president, H. R. Noack, president Pierson, Roeding & Co.; secretary-treasurer, E. B. Strong, president Journal of Elec-

tricity, Power & Gas; members of the executive committee, C. F. Butte, Ed. Whaley, E. M. Cutting, Garnett Young.

Addresses were made by President Heise, Vice-President Noack and H. H. Cudmore, director of the newly organized Pacific Coast Mazda Service Bureau, and E. S. Kellogg, assistant to the publisher of the San Francisco Call.

The following league committees were appointed to serve for the ensuing year:

Entertainment Committee.	Goodfellowship Committee.
Jos. S. Thompson	S. P. Russell
W. L. Goodwin	W. S. Hanbridge
T. E. Collins	C. H. Pennoyer
Membership Committee.	Grievance Committee.
Walter H. Seaver	Louis Levy
W. R. Dunbar	S. V. Walton
W. S. Coleman	H. B. Squires
Ways and Means Committee.	Publicity Committee.
Geo. C. Holberton	A. H. Halloran
W. W. Briggs	J. B. Lukes
W. S. Berry	C. E. Wiggin
Finance Committee.	Legislative Committee.
C. C. Hillis	F. H. Leggett
T. E. Bibbins	H. V. Carter
M. H. Thrall	W. F. Neiman

NEWS OF OREGON RAILROAD COMMISSION.

The commission has ordered that the United Railway Company be allowed to increase its rates of fare between Portland and Linnton from 5 to 10 cents and slight increases to many points beyond, on the basis of the company's showing that under the former rate the 1913 operating revenues fell short of meeting the expenses by \$73,810. The average cost of transportation between Portland and Linnton was 9 2/3 cents per passenger, of which 5.56 cents represented cost due to the movement of the passenger and 4.12 cents was general and would remain constant whether more or less passengers were transported. The average revenue was 8.55 cents, or .26 cent less than the movement cost.

The commission has found that the water rates of the Salem Water, Light and Power Company did not bear equitably on the various classes of consumers and that the rates were generally higher than in similar Pacific Coast cities. It consequently has ordered a new classification and lower rates.

ELECTRICAL PAGEANT AT SALT LAKE CITY.

Electricity played a prominent part in the celebration of the annual carnival of the Wizard of the Wasatch in Salt Lake City August 25th to 29th, the principal feature of which was the electrical pageant which was given on the evening of the 25th and repeated again on the 28th. The sixteen floats in this parade were designed by and constructed directly by Miss Emma L. Mulkey of San Francisco and represented themes in poetry, songs and stories. The principal ones were constructed on motor equipped flat cars furnished by the Utah Light & Railway Company, and these traveling under their own power along the route of the parade were unusually effective, particularly those representing boats. Over 5000 lamps were used in producing the effects desired and these were mostly concealed in coves and the light reflected against the face of the floats, thus producing beautiful effects in lights and shades without the presence of exposed lamps. The following are the themes of the floats: Columbia, Old King Cole, Rocked in the Cradle of the Deep, Old Heidelberg, The Old Woman Who Lived in the Shoe, Robinson Crusoe, Alice in Wonderland, Cleopatra, The Arabian Nights, The "Funnies," Madame Butterfly, Mother Goose, Hiawatha, and the Wizard of the Wasatch. In the Industrial parade on Wednesday the Utah Light & Railway Company entered a float in the electric truck division represented Jupiter, thunderbolt in hand in the foreground and Benjamin Franklin drawing lightning from the skies with his kite in the background.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Pacific Gas & Electric Company has filed an application asking authority to issue \$1,000,000 par value of general and refunding mortgage gold bonds to be used in protecting its surety in connection with the filing of certain surety bonds amounting to \$700,000. These bonds are to be filed with the Clerk of the District Court of the United States in and for the Northern District of California, to insure the payment by the company of any sums which the Court may require it to pay in connection with the suit brought by the Pacific Gas & Electric Company to restrain the City and County of San Francisco from enforcing the gas and electric rates provided for in certain ordinances adopted on June 23, 1913.

The Hawthorne Electric & Water Company has filed an application with the Railroad Commission asking authority to issue 1500 shares of capital stock at \$10.00 per share. The company also wishes to issue sufficient bonds to replace certain outstanding notes and to issue additional bonds from time to time to take care of additions and betterments to its system.

The Commission has issued an order authorizing the Southern California Edison Company to pledge 321 bonds of the face value of \$1000 each to secure obligations of the company. This order is an alternative to an order issued by the Commission on August 12th, in which the company was given permission to issue these bonds at 87 1/2 per cent and accrued interest. These bonds are the last remaining portion of an issue of \$2,500,000 authorized by the commission in the latter part of January, 1913.

The commission has rendered a decision denying the application of the Pacific Gas & Electric Company for a rehearing in the case brought against it by the town of Antioch, Contra Costa county. In this case, the commission reduced the top rate for lighting from 8c for the first 30 kw.-hr. to 7c for the first 20 kw.-hr.

The Fowler Independent Telephone Company, operating in the vicinity of the town of Fowler, Fresno county, has filed an application with the commission, asking authority to issue 50 shares of common stock. The company proposes to use the proceeds from this issue to meet outstanding indebtedness and provide for extensions to its system.

The commission has issued a supplemental order approving a form of deed of trust which the Southern Counties Gas Company of California proposes to execute to secure certain notes. The commission's decision provides that no notes shall be issued under this deed of trust, with the exception of \$240,500 of notes heretofore authorized, without the consent of the commission.

TRADE NOTES.

The California Street Railroad of San Francisco will be operating in about two weeks, using electricity for motive power instead of steam.

The Inter-Mountain Electric Company of Salt Lake City has a contract to complete the wiring and install fixtures for the Emanuel Methodist Episcopal Church at Second South and Fourth East streets.

On October 4 E. P. Heald will open the Heald School of Commerce, at Van Ness avenue and Post street, San Francisco, giving courses in business organization, retail management, credits and collections, salesmanship, advertising, accounting, business law, business correspondence and selling systems.

The Pacific Coast office of the Allis-Chalmers Company reports the sale of a 3000-kw., 2300-volt, 3-phase, 60-cycle steam turbo-generator as an addition to the municipal lighting plant at Pasadena, Cal. They also report an order of three 2500-kw. transformers, 87,000 volts, from the Sierra Construction Company, and the sale of 14x21 twin duplex Allis-Chalmers oil engine, direct connected to a 160-kw. a. c. generator, to the Jacksonville Ice Company of Jacksonville, Tex.

ELECTRICAL CONTRACTORS' DEPARTMENT

ELEMENTS OF SUCCESSFUL CONTRACTING.

BY C. F. BUTTE.

[Concluded.]

The method of handling your material in your stockrooms and at the buildings can increase or decrease your ultimate cost.

In regard to the purchase price of materials naturally one would believe that the maximum quantity discount is the proper method to reduce the cost of your work. While this deduction may seem real upon first glance, yet dead stock on your shelves is the same as dead wood in the firm, both eating profits and values. The quantity of any item that a contractor should purchase depends upon the margin of discounts and the length of time it will require to use up the entire lot of goods.

I believe the depreciation of value for old stock on hand at time of inventory is practically unknown to most contractors, but many of the larger supply houses depreciate 50 per cent and some 100 per cent any stock that has not moved for one year. The aim of most larger firms in regard to stock on hand is to order three months' supply and not more.

The contractor many times deceives himself by purchasing large quantities to get an extra $2\frac{1}{2}$ or 5 per cent and in the end he must try to work off a lot of junk and old stock which requires effort and time, increasing his final costs.

I do not want to be understood as advocating small purchases, but I do advocate economical purchases and in quantities to meet your live demands.

A stock record would show in what quantity you would be justified to purchase your supplies and with your net discount sheets and by a few hours' application of human efficiency you will be able to determine the sizes of your orders.

With proper attention by the contractor to this point, a common source of dissatisfaction between the contractor and jobber could be remedied and the amount of protection a jobber could give the contractor over an occasional large outside purchaser could be more easily determined. The jobbers point out that the contractor is prone to purchase in small quantities irrespective of his requirements and justly contends that the small orders cannot be handled without losing money. In this case the buyer is paying for his own extravagance, because the deficit has to be made up. One of the things that the small buyer must realize is that hand-to-mouth methods in the purchase of electrical supplies is an extravagance. He could save himself considerable money in a year if he could buy a goodly proportion of his material at maximum discount rates. In this way he could economize on cartage charges, could eliminate mistakes, and be in pocket just the difference that the jobber has to charge against him for handling his small, unprofitable orders, and what would be required to supply the same amount of material in the same period of time in bulk, thereby increasing profits.

The placing of future delivery orders for work not started should be done by every contractor, especially when the market is low.

Labor cost is an item in every contract that must be watched closely and with assiduity. As I have stated before an excessive cost of labor on a job is not always the fault of the workman, although the moral attitude, the physical temperament and the mental state of the men materially affect the total cost. The selection of honest, sober, industrious men with good health, moral habits, a cheerful disposition and some interest in their work should keep the cost of labor on an even basis and at the least possible amount.

The best results can be obtained by associating closely as possible with your men. The feeling that the contractor

will take advantage of his employees whenever possible should not exist but fair play should exist at all times with a consistent, regular and even basis of working. A spasmodic encouragement of your men, either by temporary increase of pay, or promises of long employment, does not engender harmony or sincerity either to yourself or your fellow contractors.

The method of keeping cost records, I will not touch upon, though I want to say that the contractor who states he does not keep any cost record, as he cannot keep it accurately in all details, should refer to my previous remarks on overhead expense and memorize the last part:

There were thirty-nine reasons all together

Why I failed and was put on the "run."

The thirty-ninth and most important was—

I should never have begun.

The Association.

The association of men, of crafts, is known in history as far back as the second and third centuries B. C., and has been generally induced for the pleasures of mutual enjoyment, for the advancement of intellect, for the attainment of some common cause, for which the support and co-operation of numbers were necessary.

The objects of our association and the reasons for our banding together are manifold, but primarily and practically we are banded together for one purpose of benefitting our business.

"Benefitting our business" can be applied, interpreted and defined in many ways and it is true we must apply efforts, work and energies in many ways to obtain this result. However, no matter what we do, what we can do or what we will do, will always and can always be encompassed within and defined by the word educational.

The adoption of standard materials is educational, the adoption of standard specifications is educational, the application of overhead expense in estimating is educational, the addition of a reasonable profit to our work is educational, adoption of any mutual agreements is educational and in fact we cannot act in any way or manner unless it is educational. These are all educational in the sense that we must show how any action we may take or advocate will, when applied, correct faults and errors, elevate our business; prove of value, increase our capacities, save our expenditure for expense items, give our customers a higher grade of work, and increase our revenues and profits.

There are many ways in which our association will endeavor to obtain better conditions in our business. Each and every one requires sacrifice of time, a great deal of real work and many efforts by our members, as through collective working we can only obtain anything of real sound value.

The success of any organization depends upon holding out to its members something of mutual benefit rather than benefits of an individual character. Personal differences or individual benefits must never be permitted to exist in any association, as nothing is more harmful to the affiliating of men necessarily of different temperaments and characters as this one point. Continual mutual development must take place to create the feeling of mutual help, mutual enjoyment and mutual encouragement in good endeavor and it must and will be the aim of our association to always hear these words in mind.

The work of our association during the past will bear out my assertion that the personal equation is always eliminated in the efforts put forth. With the experience gained in this work, the results we have already obtained and with the spirit of co-operation more firmly imbedded than ever

heretofore, the success, the benefits and the value the association will be to the contractor and to the many allied branches dealing with the contractor will unquestionably and without argument be manifold greater than it has ever been heretofore.

Many good deeds, many good efforts and many good results are yet to be part of the work our association will undertake, and I say our association for you, and you constitute our association and the good deeds, good efforts and the good results are only part of your work.

Standardization is now one of the questions foremost in all lines of industry.

All manufacturers of the present age endeavor to standardize their product. All business houses of note standardize their methods and why should not we standardize our work? Why should not we benefit by the experience of others? Why should we not grasp and obtain all the benefits possible that we may see others enjoy?

Standardization of materials now seems to be a vital question. Why should we be compelled to purchase a small quantity of a certain kind of material for one contract when our shelves are filled with material of the same quality, but of a different kind or make? Our association should take up the question of standardizing quality, and not make, in order that the standard stocks carried by any contractor can be used on all his work. Along these lines I may quote a clipping as follows:

"The Engineering Association of China, having headquarters at Shanghai, has undertaken the standardization of electrical supplies throughout China. This is proving a rather difficult undertaking because of the great variety of supplies now shipped into China from various parts of the world. It is recognized, however, that far-reaching benefits would result from the proposed standardization, and as a result the consuming public is encouraging the movement."

The standard specifications and specifications drawn up by engineers and specialists should be advocated by our association. Specifications drawn up by engineers not endeavoring to sell any particular make or brand of materials, but rather specifying standard quality should also be advocated by this association. The relationship the contractor should have with the engineer you will hear thoroughly discussed and I will not take up any of your time on this subject.

The handling of legislative matters pertaining to electrical construction and installation work has been always well kept in hand by our association and the possibilities along these lines in the future are great. The values we may obtain by proper legislation are considerable if our efforts are properly applied along these lines, as it is possible to enforce the keeping up of quality and standard by means of ordinances and laws when properly drawn up. Licensing of the electrical contractors has been receiving much attention of late throughout the entire country. A license tends to fix the responsibility of the contractor and enforces him to comply with all regulations and the National Code, it also tends to place the business on a higher plane.

The matter of interpreting N. E. C. rules and local ordinances is of great importance and with co-operative work between the California Inspectors' Association and our association, much good can be accomplished. The necessity of uniform interpretation is essential to standardization of construction work and the spirit shown by the California Inspectors' Association in assembling in Sacramento during our convention assures the fulfillment of our efforts along these lines.

The standardization of telephone construction work within building has been actively advanced by the telephone company and with the co-operation of our association the standards they now have in press and which apply to the entire Pacific Coast will become effective, redounding to our benefit and advancement.

There are many other questions that can only be handled and solved by the collective efforts of an association, which

I will not endeavor to touch upon at this time.

In conclusion I want to talk to the man who makes the query "What do I get out of the association?" Yes! What do you get out of the association? Do you ask the same question when you undertake anything? No—emphatically no. You expect, hope and anticipate that you may get something and work like hell to fulfill your expectations, hopes and anticipations. You never stop at the start before beginning and ask this self same question, nor do you never start at all and stay asking the question.

What would this wonderful and glorious country of ours be today, if our forefathers never started, never undertook anything, never pioneered anything, but did nothing and asked the question—What do I get out of it?

Did George Washington, the father of our country, ask this question when he crossed the Delaware on that stormy, freezing night and made the beginning of our glorious country possible? Did Abraham Lincoln, as he guarded the integrity, the welfare and the future life of our glorious states and Union during the days and nights of the strife of '61 ask this question? Did the pioneers of '49 as they started across unknown territories, unknown lands, beset by all hardships, dangers and risks—ask this question and sit idly at their original location? No—again, emphatically no, as you today would not be and could not be enjoying the delights of our beloved state, our fertile valleys and our wonderful resources. Then, why do you sit idly at your desk, table or counter and ask this self-same question? Did our mothers ask this same question as they spent sleepless nights, hours of anxiety, and days of solicitude, as they watched, protected and cared for you and me?

No gentlemen, no. The reward each expected to obtain was through efforts, through endeavors, through struggles and exertions with the fond hope, the fond expectations that such efforts may result in good.

Now, gentlemen, who ask this question—what do I get out of it—become a member, become a worker, become a part of the whole endeavor and assist the association in its work of mutual encouragement in good endeavor and when you see the results of your work and aid, you will wonder why you asked the question—What do I get out of it?

NEW CATALOGUES.

Bulletin 109 from the San Francisco office of the Busch-Sulzer Bros. Diesel Engine Company, is devoted to the power economy of the Diesel engine and its adaptability for central station work.

"Sunny Monday" is the subject of an attractive booklet from the Western Electric Company showing how the usual drudgery of washing may be eliminated by the Western Electric Washer and Wringer.

Modern Methods in Train Dispatching is the subject of a handsome bulletin from the Western Electric Company concerned with the part which the telephone is now taking in the operation of an up-to-date railroad.

Busch-Sulzer Bros. Diesel Engine Company, through their San Francisco office are distributing to those interested a reprint of an address by Dr. Diesel before the American Society of Mechanical Engineers on "The Present Status of The Diesel Engine in Europe" and a few reminiscences of the pioneer work in America.

The new illustrated catalogue of the Hess Flume Company, Denver, Colorado, is filled with engineering data for ready reference. Tables of velocity and discharge, Church's graph for $n = .011$ and the latest and most economical designs of sub-structure, wood and steel, side hill constructions, and ditch lining, show the application of the Hess flume, water meters, headgates, reservoir gates, corrugated culverts, riveted steel pipe, gate valves, watering troughs and metal garages.



NEWS NOTES



INCORPORATIONS.

LEWISTOWN, MONT.—Articles of incorporation for the Polmar Electric Company, Lewistown, Fergus county, have been filed, with capital stock of \$15,000. Roy R. Polson, Winfield J. Dittman and Harry A. Polson, all of Lewistown, are the incorporators.

ST. ANTHONY, IDAHO.—The Mesa Power Company has been incorporated to develop the waters of the North Fork of Henry's Fork of Snake River. Capital stock \$500,000. Max Hebgen, Frank M. Kerr, Henry F. Kroyer, Stephen P. Hogan and Thos. Elliott.

HELENA, MONT.—Articles of incorporation have been filed for the Springfield Telephone Company, the principal place of business being Belgrade, Gallatin county. The purpose of the company is to construct a telephone exchange in Belgrade and surrounding territory. The directors are A. E. Cramer, Henry Cramer, J. A. Forswall, and others.

ILLUMINATION.

CORDOVA, A. T.—Harry H. Knox has been granted a franchise for light and power.

HARLEM, MONT.—The town council has granted a franchise to R. J. Moore, Glasgow, for an electric light plant.

SAN MATEO, CAL.—The supervisors have called an election for September 11th when the people of Beresford will vote on the question of establishing a lighting district.

SPOKANE, WASH.—C. M. Fassett has announced that lamp posts similar to those along Riverside street will be used in the lighting project on First street. The lighting project will cost \$70,000.

MOSCOW, IDAHO.—The city council is considering a contract for a new lighting system in which it is proposed to use tungsten lamps at a considerable saving to the municipality over the present system.

RIVERSIDE, CAL.—The Lime City ornamental lighting system is again under way, the council having approved maps and estimates of City Engineer Campbell. The estimated cost of the system is \$2125.85.

LOS ANGELES, CAL.—A resolution calling election to decide whether Ocean Park Heights lighting district shall be dissolved, has been adopted by the board of supervisors and an election will be held September 15th.

COLVILLE, WASH.—The town of Addy, Wash., last week celebrated the installation of electric lights. The Stevens County Light & Power Company of this city furnishes the service from its Meyers Falls generating plant.

BOISE, IDAHO.—The public utilities commission has granted a certificate of public convenience and necessity to Dunklt Bros. for the installation of an electrical generating plant in the town of Plummer, to furnish light and power.

CATHLAMET, WASH.—The council has engaged A. A. Parker, of the General Electric Company, Portland, and Mr. Overent, of the Pacific States Company, Portland, to submit estimates of the cost of the installation of a municipal electric light plant.

CORINNE, UTAH.—A small light plant is to be installed here by the town officials, to be used in connection with the waterworks system, and to furnish light to the town. Bids will be called for at an early date for wiring the town, houses and buildings. Information may be obtained from the city clerk.

WHITTIER, CAL.—Natural gas for Whittier, La Habra and Rivera are promised for these communities by President Bain of the Southern Counties Gas Company. A supply of natural gas from the Coyote fields of the Standard Oil Com-

pany has been secured by the gas company and pipe lines will be laid at once for distribution.

MERCED, CAL.—Extensive improvement work has been begun in the local gas plant, the Merced substation of the San Joaquin Light & Power Company. Emery Wishon, assistant general manager, of Fresno, and Gas Engineer Mudell, of Bakersfield, approved plans for the work. A large gas holder will be installed and the generating facilities increased. The new holder will mean a doubling of the gas storage capacity. The work will cost about \$8000.

SEATTLE, WASH.—A resolution was introduced at the last meeting of the city council asking the corporation counsel what steps might be taken "to stop a system of hold-up and warfare upon the city plant." This was introduced with a copy of an alleged agreement of the local lighting company in which prospective customers desiring steam service are required to sign also for company light, their tenants being included under this arrangement.

PASADENA, CAL.—Manager C. W. Koiner of the Pasadena municipal lighting department has presented his annual report to the City Commission, which shows the earnings of the system for the last fiscal year to be \$176,431.30. For the year 1912-1913 the earnings were \$138,839.41. The cost per kilowatt hour for the last year was .02538 cents, as against .02868 cents for the preceding year. Operating expenses, the report declares, were 54.77 per cent of the gross income.

VANCOUVER, B. C.—A new type of arc light may be tried out for city street lighting this winter. C. R. G. Conway, chief engineer of the B. C. Electric, has suggested the use of a type which will give twice the illumination at the same cost as the present ones which have been the standard for the past six years. Those now in use are the 6.6 amp. series enclosed arc lights. The sanction of the council was needed to vary the agreement with the lighting company and this was duly given.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has won a victory in its attack on the legality of the ordinance by which the supervisors fixed the rates for electric current for 1913-14, according to the findings of Master in Chancery H. M. Wright of the U. S. District Court. The Master finds that the yield to the company from the electric rates in question is only 5.82 per cent per annum and that this, or any return less than 6 per cent is less than a fair return on capital employed in the supplying of electricity during the year 1913-14. The Master finds the total value of the company's properties engaged in supplying electricity in San Francisco to be \$10,078,671. Its gross income under the ordinance complained of he finds to be \$2,718,772 and its expenses \$2,132,014, which would leave a net income for the year 1913-14 of \$586,758. This would yield a return of 5.82 per cent on the investment. This return is decided to be unreasonable on the ground that money could not during the fiscal year 1913-14 be obtained at such a rate for investment in like enterprises.

TRANSMISSION.

JUNCTION CITY, ORE.—Farmers have requested the Oregon Power Company to extend their wires west of town to serve them.

LOS ANGELES, CAL.—Judge Hewitt has upheld the validity of the \$6,500,000 power bond issue of May 8, which was attacked by F. H. Hartigan.

SEATTLE, WASH.—Superintendent Ross included in his estimate \$45,000 for materials for placing wires underground and \$25,000 for labor for this purpose.

OREGON CITY, ORE.—The Clackamas County Court granted the Portland Railway, Light & Power Company a franchise for 25 years to erect and maintain a line of poles from Estacada to River Mill.

CHEHALIS, WASH.—Permission has been granted to the Independent Electric Company to proceed with the construction of its electric transmission line in accordance with the petition for a franchise.

TULARE, CAL.—The Mt. Whitney Power Company states that the new substation just east of Tulare will be constructed of steel and glass and will be absolutely fireproof. The plans are already under way.

LAPWAI, IDAHO.—The setting of poles by the Lewiston Electric Company for the extension of their light and power lines to this city has been completed. The wires are now being strung and current will be supplied within a short time. The total cost of this extension will be about \$25,000.

LOS ANGELES, CAL.—An advisory committee of five men, representing San Fernando Valley, will act with Chief Engineer Mulholland and the board of public service in the construction of a distributing system for that district, the board unanimously agreeing to recognize the San Fernando committee.

REDDING, CAL.—Fire destroyed the Northern California Power Company's substation at the city pumping plant and deranged the power lines that serve the city. Nine transformers burned at a loss of \$18,000. No water could be pumped into the reservoir for two days. There was no light or power for over 24 hours.

FALL RIVER MILLS, CAL.—Work on the power lines of the California Power and Manufacturing Company has been resumed, in accordance with the company's promise which they made shortly after they discharged all workmen except the foremen and local manager. The discontinuance of work caused considerable disappointment and some unfavorable comment, but since the resumption of work, a little more than a week after its discontinuance, the outlook is optimistic again. The power company's poles stretch for miles through the valley, although the wires have not yet been strung, and power is served only in Fall River Mills, as heretofore. The cause for laying off the workmen was partly a change made in the right of way on one of the lines, and also in part because the fire which burned Ray's sawmill on Pit River two weeks ago destroyed a large number of the cross arms, which the company was about ready to put in place.

TRANSPORTATION.

SAN FRANCISCO, CAL.—The formal opening of the Eleventh and Potrero avenue municipal railroad will take place September 7th.

MILWAUKEE, ORE.—An ordinance granting L. H. Campbell a 25 year franchise for a street railway on streets of this city has passed the council.

WALKERVILLE, MONT.—Manager Wharton of the Butte Electric Railway Company, states that new tracks, ties and planking will be placed on Daly street at once.

OROVILLE, CAL.—The Northern Electric Railway Company will build a new depot here during the present year, according to an announcement made following the visit of General Manager W. A. McGoveru.

OAKLAND, CAL.—Mayor Frank K. Mott and Commissioner F. O. Turner opposed the granting of permission to the Key Route system to extend its "ferry service" east of Broadway in Twelfth street direct to the mole.

SAN FRANCISCO, CAL.—The contract for constructing the Municipal Railway through the Stockton street tunnel has been awarded by the Board of Works to Eaton & Smith for \$9,775. This part of the road extends from Sutter to Sacramento street.

CHEHALIS, WASH.—The Washington Electric Company has filed a condemnation suit against the Carlisle Pennell Lumber Company for portions of right of way needed to complete the extension of the Chehalis and Cowlitz railroad from Chehalis to Onalaska.

SACRAMENTO, CAL.—At the annual meeting of the Central Traction Company the old directors were re-elected, with the exception of W. Arnstein, who was succeeded by G. A. Starkweather. A. N. Baldwin, at present secretary of the company, succeeded Arnstein as treasurer.

PASADENA, CAL.—Horace F. Dobbins, president of the Pasadena Rapid Transit Company, has proposed to the City Commissioners that he will construct a new line to Los Angeles with funds to be furnished by a city bond issue, and operate it for a certain term of years before it reverted to the city.

SEATTLE, WASH.—After a legal fight of almost four years, the Federal Court last week made valid the franchise of the Seattle, Renton & Southern Railway which had been repealed by the city in December, 1910. By the same ruling the city acquires the right to connect the municipal carline tracks over the company's tracks along Fourth avenue, and may order improvements of streets over which the Renton company's line is routed and may compel the railway company to conform to these improvements in the construction of its tracks. Mayor Gill is stated to have said that he sees no reason why the city should repeal the case.

VALLEJO, CAL.—That the Northern Electric Railway Company has no intention of abandoning Vallejo as its deep water terminal and that it will make every effort to complete its system in time for the opening of the Panama-Pacific Exposition next spring, was the assurance given the city council when Attorney Theodore H. Chester representing the railroad company, appeared before the municipal body to request the adoption of a resolution waiving certain conditions imposed on the Northern Electric by the City of Vallejo. On February 23, 1911, the Northern Electric was granted a franchise to construct and maintain its system over streets of this city upon condition that a passenger depot be erected here. The company was to commence work in six months and have the road completed in three years. The work was started in the time provided for, but has not been completed owing to the inability to secure sufficient money with which to complete construction operations. Already it has expended over \$120,000 in an effort to complete the system. Superintendent W. A. McGovern and Right-of-Way Agent James W. Grace of the Northern Electric, accompanied Attorney Chester to the city.

SAN FRANCISCO, CAL.—With more than 40 improvement clubs of the city represented, the Exposition committee of improvement organizations met a few nights ago and by a unanimous vote authorized the executive committee to make important recommendations to the supervisors relative to the city's co-operation with the United Railways to the end that adequate transportation facilities may be secured to and from the Exposition grounds during 1915. It was pointed out that, while the municipality now has sufficient trackage to handle from 50,000 to 60,000 persons an hour, it has not the rolling stock to handle more than 40 per cent of the necessary number, and from all indications, will not have. Also, under the present scheme of things, there is no universal 5c fare from various parts of the city to the exposition grounds. The executive committee was empowered to place before the supervisors a plan whereby the city and the United Railroads exchange transfers at every point where the rival trackage crosses, and that an agreement be entered into for the life of the Exposition, whereby passengers from the S. P. railroad stations at the ferry and at Third and Townsend streets, and passengers from other downtown points, be carried, by various routings, direct to the Exposition grounds.

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Pacific Electric Bldg., Los Angeles; Spalding Bldg.,
Portland; Rialto Bldg., San Francisco; Colman Bldg.,
Seattle. |
| E-1 Edison Lamp Works of General Electric Co.....12-13
Rialto Bldg., San Francisco. | P-7 Pittsburgh Piping & Equipment Co.....20
Monadnock Bldg., San Francisco. |
| E-2 Edison Storage Battery Supply Co.....17
441 Golden Gate Avenue, San Francisco. | S-1 Schaw-Batcher Company, Pipe Works, The.....17
211 J Street, Sacramento; 356 Market Street, San
Francisco. |
| E-3 Electric Agencies Co.....
247 Minna Street, San Francisco; Central Building,
Los Angeles. | S-2 Simonds Machinery Co.....
117-19-21 New Montgomery Street, San Francisco. |
| E-4 Electric Storage Battery Co.....20
Pacific Electric Bldg., Los Angeles; Spalding Bldg.,
Portland; 118 New Montgomery Street, San Francisco;
Colman Bldg., Seattle. | S-3 Simplex Electric Heating Co.....20
612 Howard Street, San Francisco. |
| F-1 Fairbanks, Morse & Co.....
Los Angeles; Portland; 651 Mission Street, San Fran-
cisco; Seattle; Spokane. | S-4 Southern Pacific Co.....11
Flood Bldg., San Francisco. |
| F-2 Fort Wayne Electric Works of G. E. Co.....
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330 So. L. A. Street, Los Angeles; 345 Oak Street,
Portland; 807 Mission Street, San Francisco. | V-1 Van Emon Elevator Co.....
56 Natoma Street, San Francisco. |
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1707 Naud Street, Los Angeles. | W-1 Wagner Electric Manufacturing Co.....17
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| H-5 Hunt, Mirk & Co.....6
141 Second Street, San Francisco. | W-4 Westinghouse Electric and Manufacturing Co.....
50-52 East Broadway, Butte; Van Nuys Bldg., Los
Angeles; Couch Bldg., Portland; 212 So. W. Temple,
Salt Lake City; 165 Second Street, San Francisco;
Central Bldg., Seattle; Paulsen Bldg., Spokane. |
| H-6 Hubbard & Co.....
Rialto Bldg., San Francisco. | W-5 Westinghouse Machine Co.....6
141 Second Street, San Francisco. |
| I-1 Indiana Rubber and Insulated Wire Co.....
807 Mission Street, San Francisco. | W-6 Westinghouse Lamp Co.....
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| M-1 Mannesmannrohren-Werke
Rialto Bldg., San Francisco. | |

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THE WAPATO LAKE DRAINAGE PROJECT

BY W. D. PEASLEE.

ELECTRIC DISTRIBUTION STANDARDS IN SAN DIEGO

BY L. M. KLAUBER.

CORRESPONDENCE FILING CLASSIFICATIONS

REPORT ON INDUCTIVE INTERFERENCE

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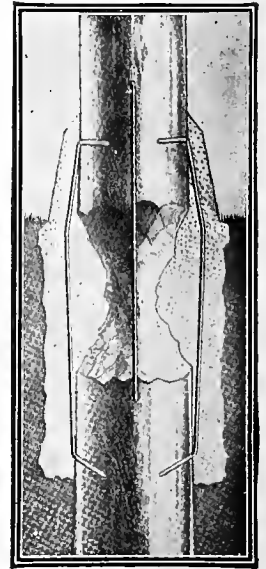
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VOLUME XXXIII

SAN FRANCISCO, SEPTEMBER 12, 1914

NUMBER 11

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THE WAPATO LAKE DRAINAGE PROJECT

BY W. D. PEASLEE.

(After a discussion of the peculiar drainage problems presented the author shows that a synchronous motor was best adapted to meet the difficulties. Details of the motor pumping installation and of the power contract are then given. Mr. Peaslee is consulting engineer at Portland, acting for the drainage company.—The Editor.)

One of the most recent applications of electric driven pumps to the reclamation of partially or wholly flooded land has just been installed by the Gaston

Before the installation of the present equipment the lake was flooded until late in the spring and it was impossible to plant crops until after the first of



Fig. 1. Wapato Lake at Time of April High Water.

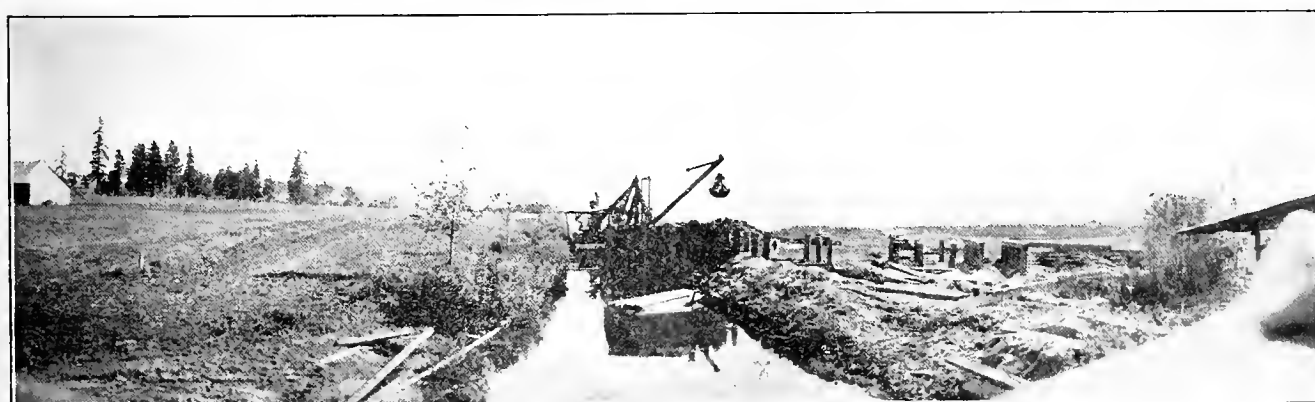


Fig. 2. Wapato Lake at Time of Summer Low Water.

Gardens Company, of Portland, Oregon, at Wapato Lake, about 30 miles southwest of Portland, on the line of the Portland, Eugene & Eastern Railway.

This lake was formed by beavers building a dam across a narrow part of the valley, flooding some 800 acres. The lake gradually filled with decaying grasses and other vegetation until today the valley is covered with a layer of this deposit varying from 4 to 35 ft. thick, the soil being classed by the Oregon Agricultural College as first class "beaver dam."

June, except in the few high parts around the edges. Fig. 1 shows the condition of the lake in April. High water was again encountered early in the fall, ruining the crops before they could be harvested, and all attempts to farm the projects had resulted more or less disastrously.

The Gaston Gardens Company, realizing the value of the land if it could be kept dry, acquired it and began a systematic campaign of reclamation. A large canal was dug, widening the natural stream that flowed

through the property, and laterals dug at frequent intervals provided thorough drainage for all parts. However, as the soil is very hygroscopic the fall was not sufficient to drain the land properly and it was found that the water level at the mouth of the canal must be further lowered. To this end a study of the situation was made with a view to the installation of a pumping plant.

The water encountered is from two sources, run-off from the tributary watershed, and back-water from the Tualatin River during its flood period. Across the lower end of the lake, between it and the Tualatin River, the county road is built on a dike, crossing

scribed was adopted, as the best solution for both parties. The motor will operate continuously and be used, whether pumping or not, to correct the power factor of the power company's line.

A crescent shaped dam, Fig. 4, connects with the dike along which the county road runs, the machinery and gate houses being built on piling driven as an integral part of the dam, with the discharge pipe running through the dam and discharging into the bed of the natural stream.

The pump is a 30 in. vertical centrifugal designed and built by the Traylor Engineering Company, rated at 32,000 gal. per minute at 8 ft. head normal and 45,000

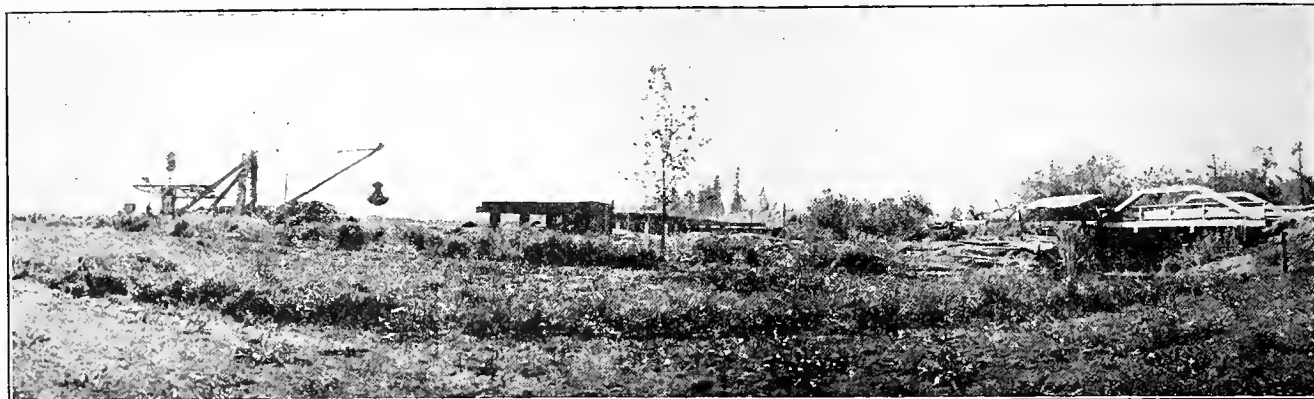


Fig. 3. Bridge and County Road Dike at Lower End of Wapato Lake.

the stream from the lake at the bridge shown in Fig. 3. To eliminate the back-water from the river it was necessary only to close this opening. As the soil at this point consisted of a thin layer of "beaver dam," overlaying a thick stratum of blue clay it was decided to install the pumping plant at this point, especially as piling could be driven to a satisfactory bearing. Fig. 4 shows the general plan of the plant and dams and sections of the dams.

Studies of the run-off, rainfall, and character of the watershed indicated that the pumping plant would have to handle 70 sec. ft. of water against a head of 8 ft. as a maximum condition, requiring about 125 h.p. This maximum demand would occur only three or four times a year and for periods of a few days or weeks at most, the pump being idle the rest of the time.

As the transmission line serving this part of the county operated by the Washington-Oregon Corporation was already heavily burdened with a rather low power-factor service this type of load was not looked upon with any great degree of enthusiasm by the power company, especially as they were already having some difficulty with voltage regulation, and were operating on power purchased at a rate determined by their highest peak demand. The superposing of this motor load on their present peak would cause a decided increase in their rate. The serving of this plant also entailed the outlay of considerable capital in transformers and line extension.

Careful studies were made of steam engine, Diesel engine, induction and synchronous motor drive for the pump and it is an interesting fact that even under these extreme conditions the first two methods were unable to compete with either form of electric drive. After many conferences with the officials of the power company the synchronous motor equipment herein de-

gal. per minute against the same head maximum. The guaranteed efficiency at normal discharge is 65 per cent. The pump operates submerged and is suspended from the framework by a steel lattice structure which is shown in Figs. 5 and 6. It is connected by a cut steel bevel gear and pinion to a horizontal shaft, driven through a Dodge-Orton friction clutch by a synchronous motor.

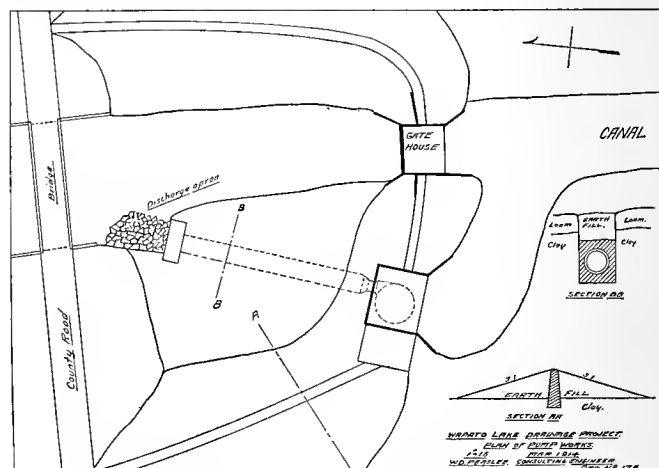


Fig. 4. Plan of Pump Installation, Showing Sections of Dam and Pipe Trench.

The motor is rated ATI-14 pole-180 k.v.a.-514 r.p.m.-2200 volt and is guaranteed to deliver 185 h.p. at 85 per cent power factor under standard conditions of overload and temperature rise. The motor is arranged for self starting and synchronizing and the amortisseur windings serve also to reduce any tendency to hunting that might arise from periodic fluctuations of the line conditions. Starting is accomplished by means of a standard three-phase compensator, equipped with overload and low voltage protection,

the overload relays of the automatic line switch giving protection during starting while those of the compensator are also in the circuit during running.

The exciter is belt driven from the motor shaft and is of the latest interpole design. All the electrical equipment was furnished by the General Electric Company.

The entire machinery is mounted on a frame work of 12x16 and 12x12 timbers supported on piling driven in the clay until no further penetration was secured. The equipment is protected by a house of galvanized corrugated iron and four windows are provided to insure ample illumination.

The discharge pipe made of wood stave is 44 in. in diameter with steel rod bands spaced 10 in. and

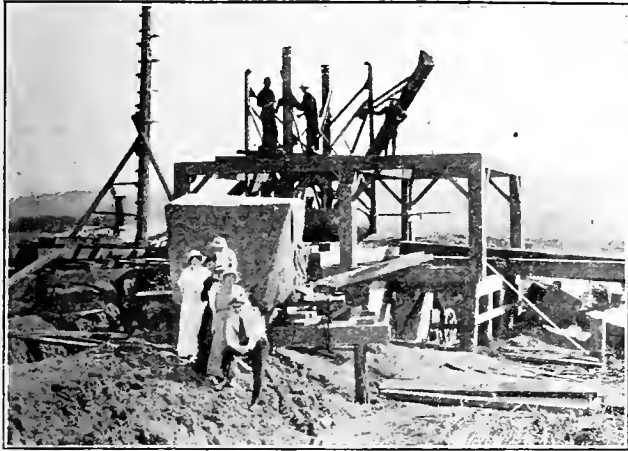


Fig. 5. Pump Assembled and Ready to Lower Into Place, Showing Lattice Supporting Structure.

is connected to the pump by a steel expansion joint. It is laid in a trench cut through the dam below the natural ground surface and then thoroughly puddled in place with clay to prevent any leakage through the dam at this point. A discharge apron of heavy boulders is provided at the discharge end of the pipe to break up the stream and reduce erosion.

The dam is an earth fill with a central clay puddle carried below the natural clay sub-strata. Sheet piling is driven around the gate house and pump pit, forming wings at the ends of the dam as shown by the heavy lines of Fig. 4.

The switchboard equipment includes an automatic line switch, field switch, line and field ammeters, and rheostat mechanisms for motor and exciter field rheostats.

The lighting circuit is supplied from a separate transformer connected outside the line switch so that lights are always available even though the line switch is open.

At present writing no tests have been made on this installation as the low water period is now on, but it is planned to make complete tests during high water to determine the efficiency of the plant.

Under present conditions the lake will be allowed to flood during the winter and the pump started about April 1 and kept running when necessary to keep the water at a safe level until the crop is harvested, when it will be again allowed to flood. Ultimate plans include a dike around the entire project and then the soil will be available at its full value.

Following are extracts from the power contract that are due to the particular type of apparatus installed:

The Power Company shall make every practical endeavor to maintain normal voltage and frequency and the Garden Company will undertake on its part that, so far as the nature of its work will permit, it will so regulate its use of electrical energy that the load will not vary suddenly more than twenty per cent (20 %) not including starting or stopping conditions and shall maintain equality of load upon the phases within ten per cent (10%) of the load of the loaded phase.

The Garden Company agrees that at its own expense it will install a synchronous motor of at least one hundred eighty (180) horsepower capacity at eighty-five per cent (85%) power factor with suitable starting compensators and that at its own expense, it will operate the said motor in connec-

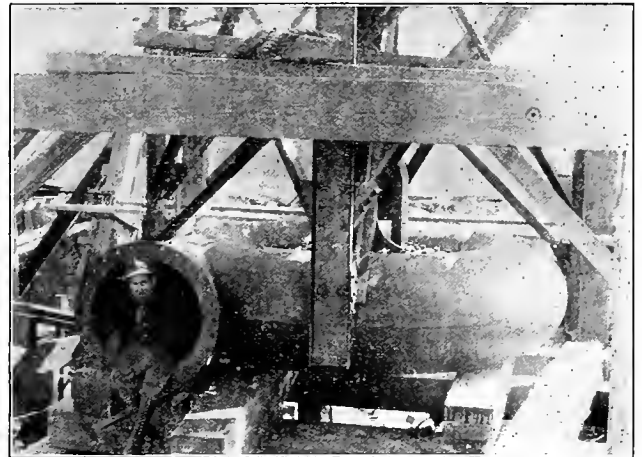


Fig. 6. Method of Attaching Steel Structure to Pump.

tion with its pump for at least seven months during the term of this contract. During the remaining five months the Garden Company shall have the right to suspend pumping operations but it shall at its own expense and at all times if the Power Company so desires continue to operate the motor independent of the pump and without load during the suspension period of pumping operations. In the event of such suspension of pumping operations the Power Company shall pay for any power by it consumed during the period of such suspension, and the Garden Company shall pay all other operating expenses.

The Power Company shall have the right and authority at all times during the term of this contract to regulate the field excitation of the said synchronous motor for the purpose of correcting the power factor on its system. The Power Company shall also have the right if it so elects to install a regulator or some other device for the purpose of automatically correcting the power factor on its system.

It is understood that for the purpose of determining the maximum peak for three consecutive minutes there shall be installed and maintained without cost to the Garden Company, graphic indicating wattmeters in the Power Company's substation at Beaverton and in the pump house of the Garden Company at Gaston.

Extract from letter from the Washington Oregon Corporation regarding power contract with the Gaston Gardens Company:

In the matter of responsibility for the operation of the motor during the five months period of suspension of pumping operations provided for in the agreement submitted by us we will agree and do hereby agree to assume this responsibility during such portion of the five months during which the motor is used solely by us for power factor correction purposes.

ELECTRIC DISTRIBUTION

STANDARDS AT SAN DIEGO.

BY L. M. KLAUBER.

D. Overhead Construction.

[Continued.]

(The fifth in the series of Mr. Klauber's articles is concerned with guys, guy wires and dead ends.—The Editor.)

The instructions contained in the handbook are as follows:

Guy and Guy Wire. D, 50, 1, 2, 3.

Size of guy wire—Use $\frac{1}{4}$ in. guy wire only in the following cases:

1. Head guys holding an unbalanced strain no greater than 3 No. 6 wires.

2. Arm guys holding an unbalanced strain no greater than 3 No. 4 wires.

3. Span guys for incandescent lamps.

In all other cases use $\frac{5}{16}$ in. guy wire.

Size of guy clamps—Use 2 bolt clamps on $\frac{1}{4}$ in. guy wire and 3 bolt clamps on $\frac{5}{16}$ in. guy wire.

Strain insulators—Use $3\frac{1}{4}$ in. glass strain insulators in $\frac{1}{4}$ in. guys, $3\frac{1}{2}$ in. brown porcelain strain insulators in $\frac{5}{16}$ in. guys, and $5\frac{1}{2}$ in. brown porcelain strain insulators in all guy wires attached to any pole carrying 11,000 volt line.

In guys running to grounded anchors place one strain insulator not less than 4 ft. nor more than 8 ft. from the pole, measured along the guy. See Sheet D. 50.6.

In span guys place two strain insulators each not less than 4 ft. nor more than 8 ft. from the near pole.

Thimbles—Use $\frac{3}{8}$ in. thimbles on all guys at point of attachment to anchors. For two guys to the same anchor use two thimbles.

Pole collars—Use pole collars on all guys attached to wooden poles or stubs.

Lag screws—Use $2\frac{1}{2} \times 3\frac{1}{2}$ in. galv. lag screws as shown in Sheet D 50.4 whenever the slope of the guy is steeper than 1 foot in 10 feet.

Cross arm guys—Use only when required by unbalanced strain. Use bridle guys only on light leads.

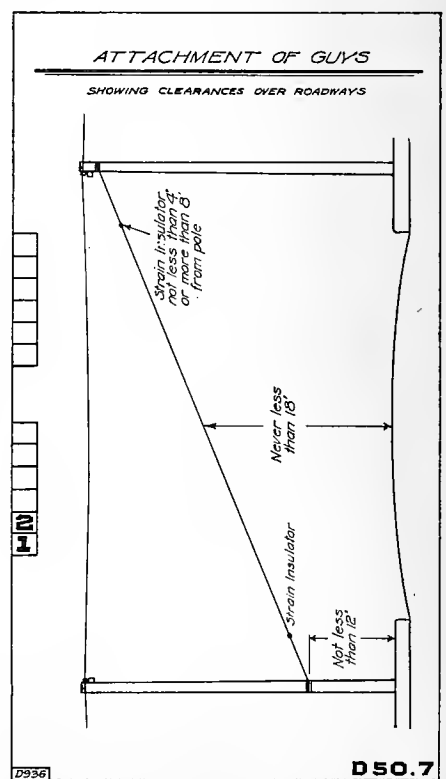
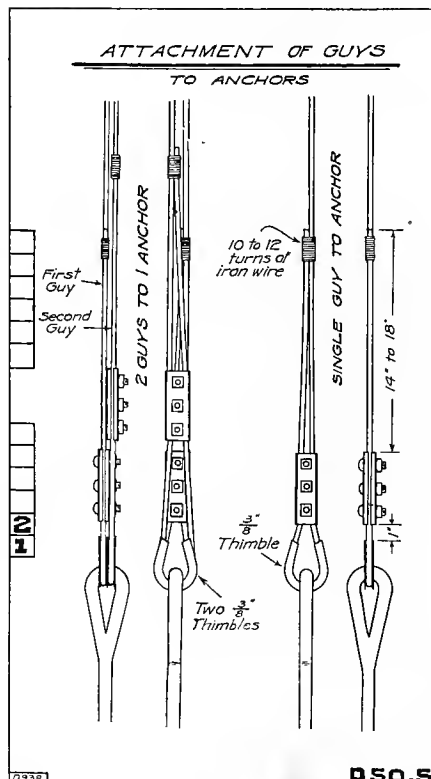
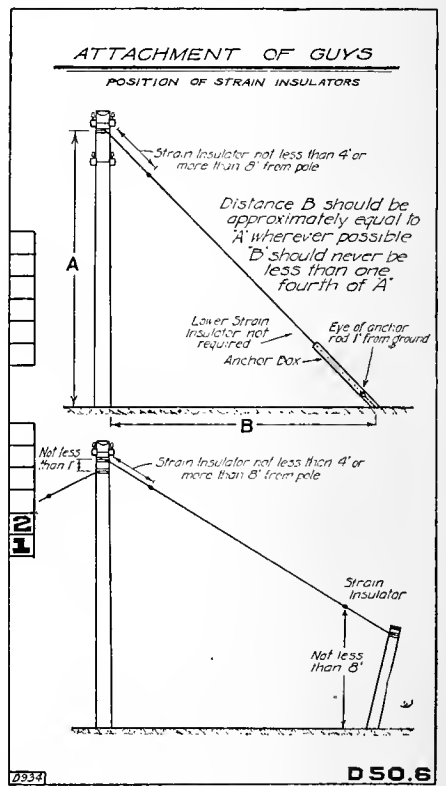
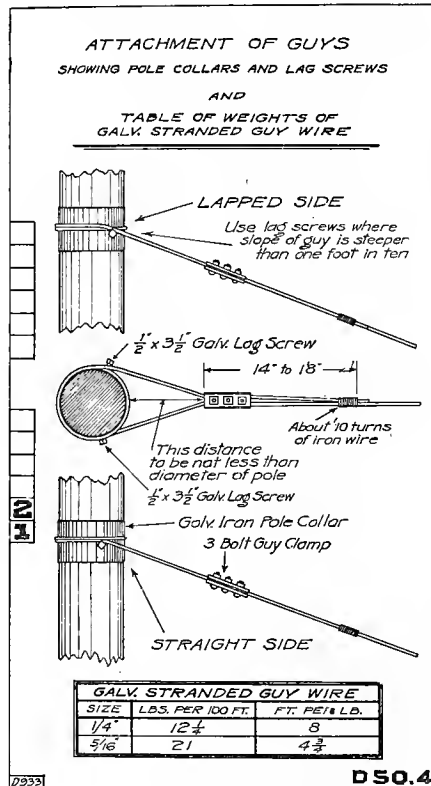
Two or more guys to same pole—When two guys hold a heavy lead to the same anchor place the first guy directly below the top arm and the second directly below the third arm.

Where two or more guys are attached to any pole carrying electric wires there must be at least one foot between any two guys at the point of attachment to the pole, regardless of whether the guys pull in the same direction or not. This does not apply to arc span poles, stubs or other poles carrying no electric wires; in such cases the guys may all be attached at the same point. (State law.)

Clearances above streets and sidewalks, of guys to stubs or poles must be as shown in Sheets D 50.7 and D 50.8.

Location of anchors—Wherever pos-

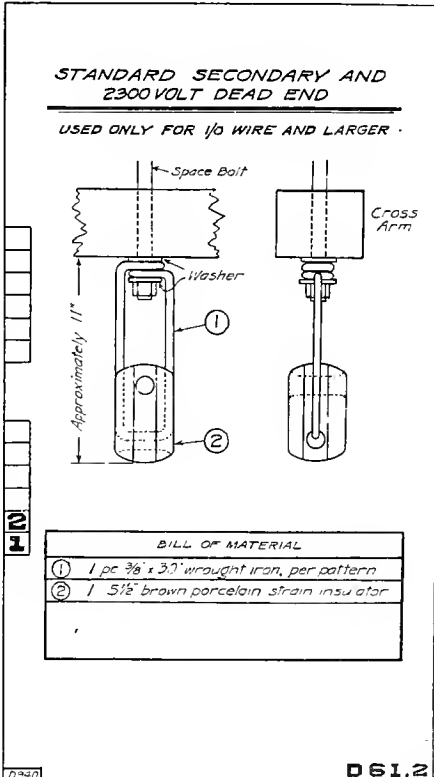
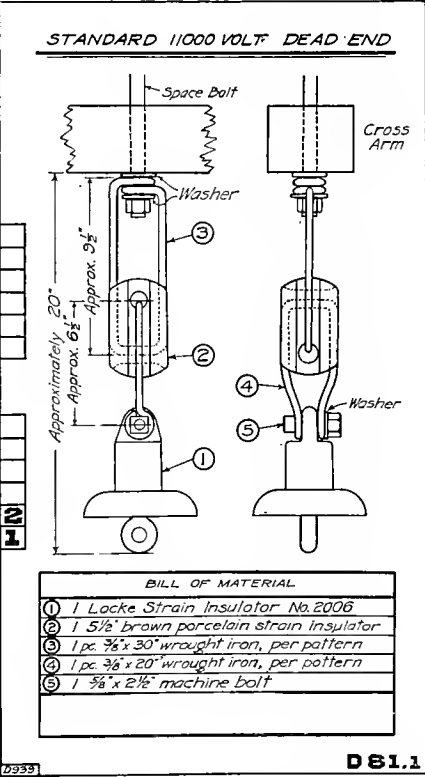
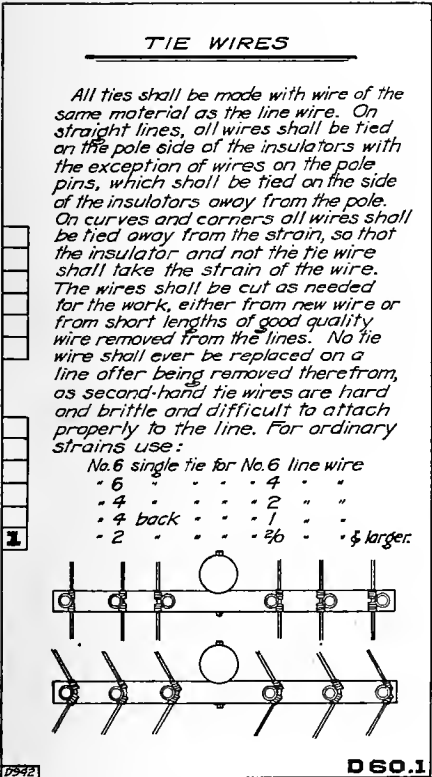
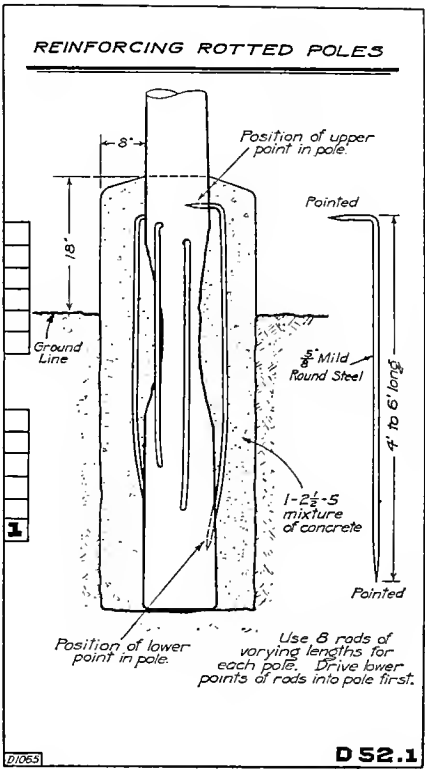
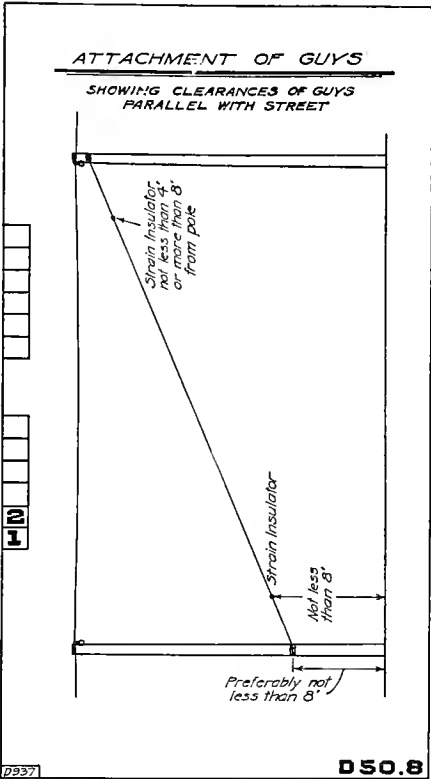
sible anchors should be located so that distance to foot of pole equals the height of the point of attachment above the ground. In no case should the distance from the pole be less



than one-fourth the height of the point of attachment above the ground.

Size of anchor rods—Use $\frac{5}{8}$ in. galvanized rod with 2 in. square nut $\frac{3}{4}$ in. thick for all regular anchors.

Use $\frac{3}{4}$ in. galvanized rod with 2 in. square nut $\frac{7}{8}$ in. thick for all anchors where 2 or more guys are brought to the same anchor.



D 60: Ties and Dead Ends. The matter on ties (D 60.1) is abridged from the N. E. L. A. Specifications. Specifications for dead ending lines contained in the book are as follows:

Dead end primaries, arcs or secondaries of No. 4 wire or smaller on break arms or $3\frac{1}{2}$ in. brown porcelain strain insulators using wire loops. No. 4 or No. 6 wires can also be dead ended on locust pins and D. G. D. P. insulators (double armed) provided it is apparent that the same line will be extended later without a break. In all cases where secondaries or

primaries are broken at a double arm, use $3\frac{1}{2}$ in. porcelain strain insulators and wire loops. Do not break between two pins of a double arm.

Dead end primaries, arcs or secondaries, No. 2 or larger, using $5\frac{1}{2}$ in. porcelain strain insulator and iron loops as per Sheet D 61.2.

Dead end 11,000 volt lines as shown on Sheet D 61.1.

All wrought iron loops to be painted with one coat of Glidden's acid-proof coating and one coat of Dixon's black graphite.

[To be continued.]

A KEY TO THE INDEX OF ELECTRICAL DEFICIENCIES, AS URGED BY THE UNDERWRITERS' EQUITABLE RATING BUREAU, PORTLAND, ORE.

BY F. D. WEBER.

In order that electrical contractors, or other persons interested, may be able to properly correct defective electrical installations, the writer has taken a list of common electrical deficiencies found in the State of Oregon—and he believes same applies to other states as well—and prepared a key pointing out at least one method of correction.

In this way the writer is attempting to perform an educational work—which is many times badly needed, and thereby conserve the money of property owners who are willing to make correction of defective electrical installations. In some cases this should also raise the efficiency of the parties upon whom the correction of a defective installation may devolve. It should furthermore incidentally reduce the cost of electrical inspection.

The method pursued in making electrical inspections with this system is as follows:

- (1) Inspector makes investigation and reports to Bureau.
- (2) Form letter sent out to owners of defective installations, enumerating defects by numbers.
- (3) Enclosed with form letter is a printed list setting forth the Index of Deficiencies.
- (4) If, deficiency is new and does not appear on printed list the back of form letter is utilized and a new deficiency made and assigned a number.
- (5) Certificate of correction at bottom of form letter to be returned to Bureau after proper correction of deficiency.

Criticism, discussion and additions to this key are invited.

Key to Index of Deficiencies.

Based on the following publications and reference will be made to same by use of underscored word.

Addenda: Addenda to the 1913 Edition of the National Electrical Code, published by the Underwriters' Equitable Rating Bureau.

Special Hazards: Recommendations for electrical installations in woodworking plants, manufacturing plants, mining plants, packing houses, warehouses, canneries, etc., published by the Underwriters' Equitable Rating Bureau.

Moving Picture Book: Specifications for the installation of moving picture machines. Published by Underwriters' Equitable Rating Bureau.

Code—National Electrical Code.

Fittings—List of Electrical Fittings, published by the National Board of Fire Underwriters.

Motor Book: Wiring Data for Direct and Alternating Current Motors. Published by Underwriters' Equitable Rating Bureau.

Note:—This key gives method of making correction of defects enumerated but does not attempt to cover every approved method of correction.

Variations of methods employed should be taken up with the Bureau or Inspection Department having jurisdiction.

Index to Deficiencies.

Adjusters:

- 1.—Unapproved cord adjusters.

See List of "Lamp Adjusters" in "Fittings"; also "Code" Rule 32, on Flexible Cord.

Attics:

- 10—Attics not properly bored and bushed.

See Code Rule 26 (f) Wires; also see "Addenda" p. 4. "All attics must be bored and bushed. Knobbing under roof joist and over floor joist will not be approved."

- 11—Attic inaccessible.

Inspector not able to gain access into same.

Boxes:

- 20—Lids not placed on outlet boxes.

See Code Rule 59 (h).

- 21—Outlet boxes loose.

See Code Rule 59 (f), also Fittings "Conduit Boxes."

Conduit:

- 30—Approved rigid or flexible conduit not used.

See Code Rule 58, also Fittings under heading "Conduit."

- 31—Conduit not locked to cabinet (a) or fittings.

See Code Rule 27 (a), also Code Rule 28 (b), and Fittings, Conduit outlet bushings, etc.

- 32—Conduit not properly grounded.

See Code Rule 27 (c), also Code Rule 28 (f), and Fittings "Ground clamps."

- 33—Condulets not installed on conduit.

Condulets and outlet boxes complying with the following:

Condulets and outlet boxes complying with the following: See Code Rule 27 (b), Code Rule 28(d) and Code Rule 59(c); Fittings "conduit boxes" and conduit outlet plates will be accepted.

- 34—Service conduit must extend to main line cutout or into cabinet if same is required.

See Code Rule 27 (a), Code Rule 28 (b), and Code Rule 12 (f).

- 35—Conduit installed without approved fittings.

See Code Rule 27 (b) (e), Code Rule 28 (d), and Code Rule 12 (f); Fittings "conduit boxes," "Conduit Outlet Bushings, Couplings and Fittings," "Conduit Outlet Plates."

- 36—Conduit (a) metal moulding system not continuous.

See Code Rule 27 (a), and Code Rule 28 (b). 36 (a) See Code Rule 29 (a).

- 37—Wires in conduit must have a double braided insulation.

See Code Rule 56; 22—Outlet boxes, (a) junction boxes, (b) condulets concealed, considered same as junction boxes; (a) See Fittings, p. 16, under heading, "Conduit Boxes"; (a) See Code Rule 27 (f) and 28 (g); (b) See "Fittings" under heading "For Use Only Entirely Exposed," p. 20.

Cords:

- 50—Cord not standard.

See Code Rule 54, and Fittings, "Rubber Covered Wire," division on "Flexible Cord."

- 51—Cords too long (a) or used other than as pendants.

See Code Rule 32 (d), Fittings; "Rubber Covered Wire," division on "Flexible Cord"; "Lamp Guards," "Lamp Adjusters."

- 52—Cords in show windows are prohibited.

See Code Rule 32 (e).

- 53—Lamp cords in bad shape (a) or hung on metal hooks, nails or grounded materials, (b) or run through partitions.

53. Worn out, (a) (b). See Code Rule 32 (d). Cords must not be run as circuits or through partitions. The system and material to use are set forth in Rule 16 Code.

- 54—Pendant cords ornamented with tissue paper or gauze.

If cords are ornamented with highly inflammable material as tissue paper or gauze, the fire hazard is increased, as this material is subjected to a steady heat if not in direct contact. Therefore, this Bureau does not sanction this practice.

- 55—Portable lamps, (a) motors, (b) fans, or (c) fixtures not connected through reinforced cord.

See Code Rule 32 (d), Fittings, "Wire rubber covered," Division on "Flexible Cord."

- 56—More than one cord in a rosette.

It is impossible for more than one "pendant cord" to hang as such from a rosette without being in contact with the other cords suspended from the same fitting. Consequently, this Bureau only sanctions the use of one cord in a rosette.

- 57—Pendant cords without knots in fittings.

See Code 32 (g).

- 58—Pendant cord attached to circuits without approved fittings.

All cords must be attached to circuit wires by approved fittings such as rosettes, bushed outlet boxes or condulets. See Code Rule 27 (b), 28 (d) and 71. See Fittings under heading "Rosettes Conduit Boxes."

- 59—Unapproved cord adjusters.

See approved List in Fittings under subject "Lamp Adjusters."

- 60—Cord circuits.

See Code Rule 32 (d). Cord (Pendant or Portable) must never be run as a circuit. A standard system of wiring must be used.

61—For pendant cords in wet or dusty places, use stranded brewery cord or packing house cord soldered direct to circuits, but supported independently; also weather sockets must be used.

See Code Rule 31 (b).

62—Two or more lights on one cord with one approved fitting.

Pendant drop lights must be installed with an approved fitting for attachment to the circuit and an approved socket for the attachment of each lamp. See deficiency (61) for exception.

63—Cord used for outside wiring not approved.

See Code Rule 32 (d). A Standard System of wiring must be used.

Cleats:

100—Three-wire cleats are prohibited.

See Code Rule 26 (h) and 62.

101—Wood cleats, staples or nails as insulators prohibited.

See Code Rule 16 (b), 62, 64, 26 (h), 26 (r).

102—Cleats should not be concealed.

See Code Rule 26 (r), unless single wire cleats are used, and it is impossible to comply with the above rule as regards separation of wires and distance from surface wired over.

103—Cleats used on outside of building.

See Code Rule 12 (d).

Cabinets:

110—Cabinets not properly made (a) or lined.

See Code Rule 70; See Deficiency 118.

111—No doors on cabinets.

See Code Rule 70 (g).

112—Cabinet doors not lined.

See Code Rule 60 (c) (d).

113—Wooden cabinets used with iron conduit.

See Code Rule 70 (b); See Deficiency 118.

114—Cabinet inaccessible.

See Code Rule 23 (c). Also as switches must be readily accessible, therefore the cabinets which they are placed in must also be readily accessible. See Code Rule 24 (a) (b).

115—Cabinet not dry inside.

See Code Rule 19 (c).

116—Cabinet not approved by N. E. C.

For construction of cabinets see Code Rule 70. See deficiency, 118.

117—Cabinets of approved type must be installed to enclose service switch and cutouts (a) lighting cutouts, (b) power cutouts, (c) fuses protecting motors, (e) rheostats.

See Code Rule 70 for construction of approved cabinets. In special hazards see "Special Hazards" Div. 18 for construction. When installed outside in the weather or exposed to dampness, see Code Rule 19 (c), also see Deficiency 118.

117.1—Cabinet too small for proper spacing of fittings inside.

See Code Rule 67-69-70.

Cabinets, Steel or Iron:

118—This Bureau will not sanction the installation of any steel or iron cabinets, except those bearing the Underwriters' label or those approved by them. (See last edition. List of Approved Electrical Fittings.)

Any person desiring to start the business of manufacturing cabinets can get full instruction regarding the label service by applying to the Underwriters' Equitable Rating Bureau.

Circuits:

120—Circuits overloaded.

See Code Rule 23 (d).

121—Circuits overfused.

See Code Rule 23 (e).

122—Circuits with more than 16 outlets approved only on written promise that current shall not exceed 660 watts.

See Code Rule 23 (d).

123—Insulation resistance of wires and fittings not sufficient—meter reading obtained when the circuit is apparently open.

See Code Rule 88.

Fittings:

130—Broken fittings.

All electrical fittings in old installations must be maintained in good condition, and no broken fittings installed in new installations.

131—Fittings loose from support.

All electrical fittings which are provided with screw holes, bolt holes or threads, must be installed in such a manner as to be secured firmly in place by making use of screws, bolts, lock nuts and bushings or screwing directly on to some rigid support. In general all fittings must be held rigidly and securely in position independently of the circuit wires to which they are attached. It may be necessary in many cases to furnish extra backing or supports to comply with this requirement. Also many times fittings become loose in existing installation and must be again secured in position.

132—Unapproved fittings (as snap switch.)

See Fittings for all approved electrical fittings. If a fitting is of very recent manufacture it might not appear in the list, and specific fittings which do not appear in the list should be taken up with the Bureau, to determine whether same is standard or not.

133—Improper use was made of approved forms of fittings.

Sometimes fittings which are approved for one class of work are used in connection with installations where the use of this approved fitting will make a hazardous condition. Therefore, approved fittings must be used in locations and in connection with wiring systems for which they are designed.

134—No support provided for fittings.

Electrical fittings, in general, must not be supported on circuit wires. They are generally furnished with provisions for support by screws, bolts, or screwing or backing to conduit.

135—Unapproved fittings.

See Fitting Book; See Code Rules; Class D 49 to 83.

Fuses:

140—Unapproved (a) or improper use of open link fuse blocks.

See Fittings under heading "Fuses, Open Link"; See Code Rule 23 (c) (d); See Code Rule 67.

141—Too many lights dependent on final fuse block.

See Code Rule for installation of 1 (d), 2 (e), 19, 23, 38 (d) and (e), 39 (h), 85 (m). Required capacity of .8 (b), 23 (d) and (e).

142—Cartridge fuse block bridged with string fuse or wire.

Only cartridge fuses must be used in cartridge fuse blocks. Substitutes are prohibited.

143—Improper fuse block (a) or none at entrance.

See "Fittings" under headings, Fuses, Enclosed Fuses, Open Link; See Code Rule 67. 143—(a) See Code Rule 19 (a); See Code Rule 23; See Code Rule 85 (m).

144—Arc lamps not fused individually.

See Code Rule 33.

145—Fuse block located over or near inflammable material.

See Code Rule 19 (b); See Code Rule 23 (c).

146—125 volt fuses on 220 volt circuits.

See Code Rule 67; See Code Rule 68; See Fittings under heading "Cut-Out Bases." Fuses Enclosed" and "Fuses, Open Link."

147—Fuses too large to protect circuit.

See deficiency 141, also Code Rule 18.

148—Refilled (a) or (reinforced) fuses.

The Underwriters' Lab. Inc have never approved any make of refillable use; 148 (a) Fuses must never be reinforced by any material whatsoever and as this destroys all their protective value after being reinforced may "blow" at almost any overload and in a large percentage of cases not at all.

149—Cutouts (a) fused switches of too large a rating to properly take fuses which will protect system.

Cutouts are constructed and designed to take fuses between certain standard ampere ratings and will not take any other capacities. Cutouts designed for 101-200 amp. capacity must not be used where 30 amps. only is required to properly protect the circuit. See Code Rule 67 and 68; 149 (a), See Def. 149 and Code Rule 65.

Flexible Tubing:

170—Flexible tubing too short at outlets.

See Code Rule 26 (u) (s); See Fittings under heading "Tubing-Flexible."

171—Flexible tubing used through floors or in damp places.

See Addenda Page 95; See Code Rule 16 (d); See Code Rule 26 (r).

172—Service wire bushed with flexible tubing; must be porcelain or conduit

See Code Rule 12 (f).

173—Where wires are not spaced 5 inches, every wire must be separately encased in continuous flexible tubing.

See Code Rule 26 (r); See Addenda, page 5.

174—Porcelain and flexible tubing out of place.

All porcelain or flexible tubing which is used in connection with a system must be retained in its proper position.

This can be done by the use of taps, knobs, cleats or other fittings.

Feeders:

200—Feeders overloaded.

Fixtures:

210—Electric fixtures not properly installed.

See Code Rule 24 (e); See Code Rule 26 (v) to (y); See addenda, pages 5 and 6.

211—Fixtures canopies on top of circuit wires or pendant switch wires.

Fixture canopies may be punched and bushed with approved bushings for the wires to pass through as flexible tubing or porcelain placed on wires for the canopies to rest on.

212—Not properly insulated.

See Code Rule 30 (a); See Fitting under heading "Insulating Joints and Canopy Insulators"; Addenda, page 6.

213—Chain fixtures in show windows are prohibited.

See Code Rule 30 (c).

214—Broken or (a) loose from support.

No broken fittings should ever be installed and when fittings in existing installations become broken they must be replaced. 214 (a) Fittings must be secured in position by screws and bolts.

Grounding Low Potential:

220—Low potential circuits not properly grounded on the direct current three-wire system, (a) alternating current secondary system.

See Code Rule 15.

221—Ground connections not made according to rules and requirements of N. E. C.

See Code Rules Ground Connection 15.

Ground Wires—

For armored cables.....	27 (c)
For interior conduits	28 (f)
For lightning arresters, 5 (c), 40 (j), 85 (l)	86 (a)
For metal moulding	29 (d)

Grounding—

Armored cable	27 (c)
Dynamo and generator frames	1 (c)
Interior conduits	28 (f)
Low potential circuits	15
Metal moulding	29 (d)
Motor frames	8 (a)
Sheaths of cables	12 (h)

See Fittings under heading "Ground Clamps."

Heating:

225—Electric iron improperly installed.

See Code Rule 25.

Hazardous:

230—Installation in such a hazardous condition that same should be completely re-wired.

Insulators:

240—Improper canopy insulator (a) or none preventing contact between canopy and steel ceiling, gas pipe or grounded surfaces.

See Code Rule 30 (a); See "Fittings" under heading "Insulating Joints" and "Canopy Insulators"; See Addenda, page 6.

241—Cross-over tubes or insulators not properly fastened in place.

See Deficiency 174; See 242.

242—Insulating joints must be used.

See Code Rule 30.

Joints:

260—Joints not soldered, (a) or taped, (b) or properly made.

See Code Rule 16 (c).

261—No rubber tape on joints.

See Code Rule 16 (c).

Lamps:

270—Lamps hanging against woodwork. When incandescent lamps are hung against woodwork the heat of the lamp will char the wood in a very short time and sometimes even cause same to immediately ignite. The ignition sometimes does not take place until a strong current of air happens to strike the charred place then it will burst into flames.

See Code Rule 32 (d); See Fittings "Lamp Guards."

271—Open arc lamp inside of building.

See Code Rule 21; See Code Rule 33.

272—Miniature light wiring not approved.

Miniature sockets are only approved inside of buildings. See Fittings under heading Sockets. Subdivision Candelabra and Miniature. All wiring to these sockets must be standard also.

273—Lamps must be equipped with approved lamp guards. See Fittings under heading "Lamp Guards"; See Code Rule 32 (d).

274—Single or grouped display lamps on special electrical effects not properly installed. Many times merchants and business houses build up all manner of advertising "stunts" without any regard to Code requirements and which are extremely hazardous.

Loose:

290—Bad or loose connections at fuse blocks and switches. All connections to fuse blocks and switches must be made in a tight and secure manner.

291—Switches loose. Switches must be held in position by independent supports other than those of the circuit to which they are attached.

Lugs:

300—No terminal lugs used.

See Code Rule 16 (c).

Moulding:

310—Moulding not properly made (a) or painted, (b) or used in damp places.

For wooden mouldings see Code Rule 60 (a), (b), 310 (b) See Code Rule 26 (b); Metal moulding, See Fittings "Moulding Metal."

311—Moulding without capping.

All moulding must be installed with capping. Wooden moulding, see Code Rule 60 (b).

312—Moulding run on grounded surfaces without backing. When wooden moulding is run on grounded surfaces, the same must be secured to a wooden backing and not directly to grounded surface.

313—Soft wood moulding used instead of hard wood moulding.

See Addenda, page 4; See Code Rule 60 (b).

314—Moulding installed without taplets.

See Code Rule 26 (k); See Fittings heading "Moulding Fittings."

315—Concealed moulding.

See Code Rule 26 (l).

Motors:

330—Motor overfused.

See Code Rule 8 (b) (c); See Code Rule 23 (e); See "Motor Book."

331—Motor should be enclosed.

See Code Rule 8 (b); See Code Rule 8 (f).

332—High potential motor frames not grounded (a) conduit, (b) sheath of the lead covered cable.

See Code Rule 8 (b).

333—High potential motor not installed according to National Electrical Code.

See Rule 8 (b); See Code Rules 44 to 46; See Code Rules 47 to 48.

334—Motor base frames not permanently grounded (a) not thoroughly insulated.

See Code Rule 8 (a); See 335.

335—Remote control of motor unapproved.

See Code Rule 8 (c).

Outlets:

340—Outlets not in use should be thoroughly taped up. At all outlets where ends of wire are exposed and are not attached to approved fittings, the same should be thoroughly taped up.

Outline Lighting:

345—Method of installing "outline lighting" not approved by National Electrical Code.

See Code Rule 39.

Protectors:

350—No protector (a) or improper protector at entrance on telephone or signal wires, (b) or protector improperly located.

See Code Rule 85 (g); See Code Rule 85 (j) (m); See Fitting under heading "Protectors."

Receptacles:

360—Lamp receptacles with exposed lugs or contacts in show window. Due to the fact that show windows contain a miscellaneous assortment of merchandise, lamp receptacles with exposed lugs or contacts must not be used.

361—No sub-base under snap switch (a) or receptacles.

See Code Rule 24 (f). When concealed type of receptacles are used with exposed knob and tube work, sub-bases must be used also; See Fittings under heading "Receptacles."

362—Unapproved receptacles.

See Fittings under heading "Receptacles."

Rosettes:

370—Unapproved rosettes.

See "Fittings" under heading "Rosettes."

Rheostats:

380—Rheostat not properly mounted.

See Code Rule (4). Nearly always rheostats are shipped for switchboard mounting and therefore have to be mounted before being installed. See 381.

381—Rheostat not properly enclosed by netting (a) in a dust-proof and fire-proof cabinet (b) by dust-proof face plates.

Rheostats built up by private parties, many times are of open coil construction. The same not being enclosed by a fine mesh netting. This being necessary in case the coils burn up and the netting will then prevent the fused portions of the coils from coming in contact with combustible materials.

381 (a) When rheostats are not provided with dust-proof face plates they must be enclosed in a dust-proof and fire-proof cabinets, if exposed to wetness, dusty or linty places.

381 (b) See Code Rule 4 (a).

See Code Rule 24 (a).

Signal Systems:

385—Signal system not installed according to the National Electrical Code.

See Code Rule 85.

Switches:

390—Improper switch (a) or none on fan or motor circuit.

See Code Rules where double poles are required 8 (c), 19a. Where indicating is required 8 (c); Must disconnect all the wires 19 (a), See Fittings under heading "sws."

391—Improper switch (a) or none at entrance point.

See Code Rule, must be indicating 65 (a) and (b), must disconnect all the wires of the circuit; 19 (a), Service switch; 20 (b), 24 (a), 65 (a); See Fittings under heading "sws."

392—Entrance switch improperly located (a) or not readily accessible.

See Code Rule 24 (a).

393—Entrance switch (a) or fuse on house side of meter.

394—Knife switch inverted (a) or located on line side of entrance fuse.

See Code Rule 24 (b); See Code Rule 24 (a) and 19 (a).

395—120-volt switch on 220-volt circuit.

See Code Rule 65 for proper spacing of parts.

396—No sub-base under snap switch (a) or receptacles.

See Code Rule 24 (f).

397—Switch and cutout must be placed in approved cabinet.

See Code Rule 70; See Addenda, page 8; Cut-out and switch. Use of—19 (b) to (d), 23 (c) and 24b; For rheostats and auto-starters, when required 8 (d). Sometimes in the judgment of the inspector conditions are such that cabinets are required in locations and under conditions not covered in the N. E. C.

398—Main service switch and fuse too far from the entrance of service wires to building.

See Code Rule 24 (a). Service switch and cutout must be placed as near entrance of service wires to a building as is possible in order to get protection for the building. If this is not done, heavy short circuits, or grounds may burn the service wires up and cause fire and when this distance is of appreciable length the fire hazard from trouble is increased unnecessarily.

399—Motor switch and cut-out must be placed in cabinet.

See Def. 397; See Code Rule 19 (b).

401—Main or branch switches wired in "hot."

See Code Rule 24 (b); See Code Rule 69 (a).

See Code Rule 19 (d).

Signs:

420—Electric signs not constructed and installed according to National Electrical Code.

See Code Rule 83; See Addenda, page 8.

421—Sign flashers must be installed in approved standard iron cabinet.

Sockets:

430—Lamp sockets not bushed.

See Code Rule 32 (f).

431— $\frac{1}{4}$ in. sockets used on reinforced cord instead of $\frac{3}{8}$ in. sockets.

The $\frac{1}{4}$ in. sockets are so small that the requirement of Rule 32 (f) requiring bushings in same cannot be complied with. Therefore the $\frac{3}{8}$ in. socket must be used.

Switch Boards:

440—Not constructed of slate, marble or approved composition if constructed prior to 1913 skeleton form hardwood passable.

See Code Rule 3.

441—No approved ground detector.

See Code Rule 7.

Trolley Current:

450—Current for motor (a) or lights taken from trolley current.

See Code Rule 42. This applies to connections direct to trolley wires with grounded or insulated return when generator or converters are grounded. It also applies to systems which are attached to trolley system bus-bars, whether or not the distribution system is a two wire insulated circuit or ground return.

451—Current for motors (a) or lights taken from trolley bus.

See Deficiency 450.

Theatres and Moving Picture Establishments.

460—Theatre and moving picture establishments, (a) dressing rooms, (b) auditorium, (c) stage, (d) lobby, not installed in approved conduit.

See Moving Picture Book; See Code Rules; Dressing Rooms 38 (j), Auditorium 38 (t), Stage 38 (b), Lobby same as Auditorium; See Fitting Book; under heading Conduit.

462—Moving picture theatre not installed according to standard specifications.

See "Moving Picture Book"; See Code Rule 38 (u) and (v).

463—Service not according to rules and requirements of National Electrical Code.

See Code Rule 38.

464—Footlights (a) borders, (b) proscenium sidelights, (c) strips, (d) proscenium lights, (e) portable equipment, (g) switchboard, (h) stage pockets, not installed or constructed according to the National Electrical Code.

See Code Rules; Footlight 38 (d), Borders 38 (e), Border Cables 54 (l), Proscenium Sidelights 38 (e), Strips 38 (m), Proscenium Lights 38 (e), Portable Equipment 38 (k), Portable Plugging Boxes 38 (n), Portable Conductors 383 (p), 54 (c), Switchboards 38 (c), Stage Pockets 38 (f); See Fittings "Theatre Appls."

465—Exit and emergency lights not fed from a point ahead of main service switch and cutout.

See Code Rule 38 (a).

466 (a) Supply must be of No. 8 because of the starting current of the arc lamps.

466 (b) See Fitting Book under heading "Receptacles" for attachment plugs; "Stage Receptacles."

466 (c) See Code Rule 54 (i); See Fittings "Flexible Cord."

Transformers:

480—Not of approved make.

See Fittings "Transformers"; subdivision Bell Ringing.

481—Sign transformer not properly mounted (a) or not of approved make.

See Code Rule 11, 14 (a) and (b), 36, 45; See Fittings "Transformers."

482—Transformer cases not thoroughly grounded.

See Code Rule 11.

[To be continued.]

EFFICIENT POWER PLANT MANAGEMENT

CORRESPONDENCE FILING CLASSIFICATION

[Concluded.]

- 720—Machinery and Tools.
- 721—Steam Boilers and Accessories.
- 721.1—Boilers.
- 721.2—Grates and Stokers—Stacks and Flues—Draft Equipment.
- 721.4—Feed Water.
- 721.42—Feed Water Heaters and Economizers.
- 721.43—Hot Wells.
- 721.5—Steam.
- 721.51—Superheaters.
- 722—Prime Movers and Auxiliaries.
- 722.1—Steam Engines and Steam Turbines.
- 722.11—Steam Condensers.
- 722.12—Cooling Towers and Sources of Cooling Water.
- 722.2—Gas, Gasoline and Oil Engines.
- 722.3—Water Wheels—Water Turbines.
- 722.31—Governors for Water Wheels and Water Turbines.
- 723—Mechanical Transmissions.
- 723.1—Shafts.
- 723.2—Gears.
- 723.3—Pulleys.
- 723.4—Belts.
- 724—Lifting and Transporting Equipment.
- 724.1—Cranes and Derricks.
- 724.2—Power Shovels—Graders—Excavators.
- 724.3—Elevators—Lifts—Hoists.
- 724.4—Industrial Cars and Tracks.
- 724.5—Wagons—Scrapers—Wheelbarrows—Horses
- 724.9—Other Lifting and Transporting Equipment.
- 724.91—Rope—Chain—Steel Hoisting Cable.
- 725—Concrete—Gravel—Rock and Sand Equipment.
- 725.1—Crushers.
- 725.2—Screens—Washers—Driers.
- 725.3—Mixers.
- 727—Machine Tools and Shop Equipment.
- 727.1—Lathes—Shapers—Drill Presses—Planes—Shears—Riveters.
- 727.2—Forges—Anvils—Welding Outfits—Blacksmith Equipment.
- 728—Small Tools.
- 728.1—Earth Working Tools.
- 728.11—Picks and Shovels.
- 728.12—Bars and Drills (Power Hand Drills)
- 728.2—Line Construction Tools.
- 728.3—Engineers' and Surveyors' Instruments.
- 728.4—Laboratory Equipment.
- 728.9—Miscellaneous Small Tools.
- 729—Other Machinery and Tools.
- 729.1—Scales and Other Weighing Devices.
- 730—Operating Supplies for Stations.
- 731—Fuel and Oils.
- 731.1—Coal (Gas and Steaming).
- 731.2—Oils.
- (If Transformer Oil, file under 324.) (If Switch Oil, file under 322.) (If Lightning Arrester Oil, file under 334.)
- 731.21—Fuel Oil—Distillates—Gasoline—Naptha—(Gas and Steaming.)
- 731.22—Lubricating Oils.
- 731.23—Illuminating Oils.
- 731.29—Other Oils.
- 731.3—Wood.
- (If for structural purposes, file under the 712 series.)
- 731.4—Coke.
- 731.9—Other Fuels.
- 739—Petty Station Supplies.
- 739.1—Cotton Waste and Wiping Rags.
- 740—Pumps—Pipe—Penstocks—Valves—Fittings—Hose—Accessories.
- (If part of electric customer's equipment, file under 366.1 series.)
- 741—Pumps—Air Compressors—Blowers.
- 742—Pipe—Penstocks.
- 742.1—Leakage.
- 743—Valves and Hydrants—Service Cocks.
- 744—Fittings.
- 745—Hose.
- 749—Accessories.
- 749.1—Pressure and Vacuum Gauges.
- 749.2—Lead—Oakum—Yarn—Gaskets—Packing.
- (See 739.1 for Waste and Rags.)
- 750—Office—Camp—Commissary—Equipment—Furnishings—Supplies.
- 751—Office Equipment and Supplies.
- 751.1—Furniture and Furnishings—Curtains—Awnings—Rugs—Safes.
- (For lighting fixtures, see the 361 or 461 series.)
- 751.2—Mechanical Office Equipment—Typewriters—Adding Machines—Cash Registers—Cameras—Fire Extinguishers.
- 751.3—Office Supplies.
- 751.31—Printed Forms—Paper—Stationery.
- 751.32—Catalogues—Price Lists—Discounts.
- (Note:—File under the specific equipment or thing involved, is possible.)
- 751.39—Petty Office Supplies—Pencils—Ink Erasers—Rubber Stamps, Etc.
- 752—Camp and Commissary Equipment and Supplies.
- 752.1—Tents.
- 752.2—Kitchen and Dining Room Equipment—Stoves.
- 752.21—Coke Heaters.
- 752.3—Food Stuffs.
- 752.4—Merchandise—Clothing—Tobacco, Etc.
- 752.5—Bunkhouse Equipment—Cots—Mattresses—Bedding, Etc.
- 790—Other Materials and Supplies.
- 791—Powder and Dynamite.

Telephone service at Shanghai is provided by a local company, which utilizes 5000 telephones, and is at present building an additional exchange in the residential part of the city. The telephone instruments now used by the company were manufactured in Sweden, and are far from being as satisfactory as those in use in the United States. The Shanghai Mutual Telephone Company, (Ltd.) was organized in March, 1900, and, during its 14 years of existence, has grown steadily. The nominal capitalization of the company is \$600,500, divided into 20,000 shares of the par value of \$31.125 each. There have been issued 14,540 shares at par value, making a total of \$452,557.50 paid in. On this sum the company paid, at the end of the last fiscal year, a dividend of 8 per cent

P. P. I. E. MACHINERY EXHIBITS

FIRST P. P. I. E. EXHIBIT.

The Department of Liberal Arts enjoys the distinction of having the first completed exhibit installed at the Panama-Pacific International Exposition. This is a "working exhibit" in the Palace of Liberal Arts by the Star Electric Company of Binghamton, New York, and forms the Central Fire and Police Alarm Signal Station for the entire exposition grounds.

While the Star Electric Company's exhibit is the first exhibit installed on the Exposition grounds it is the only one so far installed in the Palace of Liberal Arts, although there are enough other applications on file to more than fill this capacious building.

The Chief of Liberal Arts, Theodore Hardee, has been ready since last May to allot all the space at its disposal, but has been compelled to delay these allotments until the authorities at Washington decide

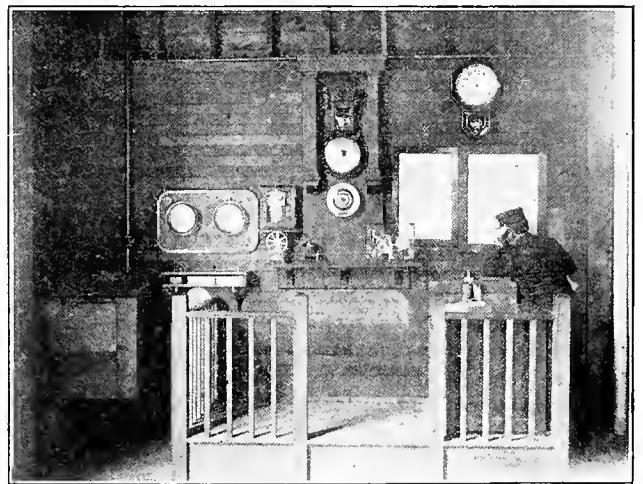
There are 102 fire alarm boxes of the latest approved type now installed throughout the grounds and buildings. These boxes are known as the type "C" or metropolitan boxes and are absolutely non-interfering and successive and so constructed that nine boxes may be pulled simultaneously and all of them will register in succession their respective signals.

Before the advent of this type of box, the greatest number of boxes which could be pulled simultaneously and insure a correct record was three. The insulation of the type "C" boxes is very high, as it has been proven by tests under actual working condition that 6500 volts will not injure them.

Each of the three engine houses in the grounds are equipped with an ornamental pressed steel panel, on which is mounted a twelve inch electro-mechanical gong, punch register, tapper bell, take-up reel and an



Central Office Equipment.



Engine House Equipment.

whether the United States Government exhibit shall remain in the Palace of Liberal Arts or be housed in the special building recently provided by Congress. If the Government Exhibit Board relinquishes this large amount of space now assigned to it a complete reapportionment of the floor area must be made and the many applicants now on the reserve list will also be accommodated. It is expected that this matter will be determined at an early date and the allotment will then be made with all possible dispatch.

Installation was started by the Star Electric Company, on May 16th, of this year, the system being put into actual operation with 52 boxes in service on July 25, 1914.

The fire alarm system comprises a central office full automatic equipment, consisting of a twelve circuit switchboard, an eight circuit automatic repeater, with four local engine house circuits; signal wheel transmitter for transmitting still and special alarms; a punching register, take-up-reel and automatic time stamp for recording the exact time that an alarm comes in, the stamp being controlled by a self winding clock. Metal battery racks carrying storage batteries for operating both fire alarm and police telegraph systems. All testing of lines and batteries and battery charging is controlled from the main switchboard.

automatic light switch, which turns on the lights in the engine house on the first stroke of the alarm, these lights being automatically turned off by the switch at a predetermined time, after the fire apparatus has left the house.

There is also a similar set of apparatus in the headquarters of the exposition military guards, in the Service Building.

There will be 102 seven call combination police telephone and signal boxes. These together with the fire alarm boxes are mounted on ornamental iron pedestals, surmounted by a red globe on which is etched "Fire Alarm" in white letters. A 25 watt Mazda lamp is used to illuminate the globe at night, to indicate the location of fire alarm and police boxes, and by means of a signal wheel transmitter, operated by an electric motor in the central office, code signals will be flashed on these lamps, to notify the guards that their services are required.

The central office police telephone and signal system, is in the same booth with the fire alarm system. A six circuit storage battery and central board provides facilities for charging storage battery and making tests and connections. In addition to this, there is a four circuit police desk, through which reports from guards and telephone calls are received.

REPORT ON INDUCTIVE INTERFERENCE.

(A report of the results and recommendations to the Railroad Commission of California by a joint committee authorized by the Commission to investigate remedies for the inductive interference of power lines with telephone communication. The findings were presented as a paper at the Spokane A. I. E. E. meeting on September 11, and the recommendations form the basis of an order from the Commission.—The Editor.)

The following paragraphs summarize very briefly the principal results accomplished to date. These statements of results are accompanied by brief explanatory comment upon the conclusions reached. The reasons for and explanations of these conclusions are given in more detail in the appendices to which reference is made.

1. *Interference to telephone circuits under normal operating conditions of power circuits arises almost wholly from the harmonic voltages and currents of the power systems. (See Appendix I).*

This is due chiefly to the fact that the frequencies of the harmonics generally present in the voltages and currents of power systems cover a considerable portion of the range of the voice frequencies particularly those frequencies at which telephone instruments and the human ear are of maximum sensibility. Extraneous currents of frequencies approaching the average voice frequency have a more injurious effect upon telephone conversation than currents of lower frequencies.

2. *The effect of induction of the fundamental frequency on telephone circuits is comparatively unimportant unless it is of magnitude sufficient to constitute a physical hazard. (See Appendix I).*

This is due to the fact that the fundamental approaches the lower limit of audible frequencies, at which the telephone and the human ear are not efficiently responsive.

3. *Interference to telegraph and other signaling circuits is due principally to the fundamental and lower harmonics. (See Appendix I).*

Telegraph receiving instruments are relatively insensitive, as compared with the telephone, to the higher harmonics, but are sensitive to disturbances of lower frequencies, such as the fundamental and lower harmonics which more nearly approach the normal operating frequency of such circuits.

4. *The power circuit currents and voltages may be divided into two factors: balanced and residual, of which, for equal magnitudes, the latter in general produce the greater inductive interference. (See Appendix II).*

Residual currents and voltages act inductively in a similar manner to single-phase currents and voltages acting in a circuit composed of the line conductors in parallel with earth return, which is a condition favorable to very large induction. Moreover, such a circuit which includes the earth as one side cannot be transposed. Transpositions in the power circuit cannot reduce the inductive effect of residuals except as they reduce the magnitudes of the residuals themselves, which they do in some cases. The inductive interference, arising from such currents and voltages can be reduced only in the case of metallic circuits such as telephone circuits, by transposing these circuits. It is therefore important that the telephone circuits be transposed at frequent intervals throughout parallels and carefully balanced throughout their entire length and that the residual currents and voltages be kept sufficiently small to give negligible induction in telephone circuits so arranged.

5. *Inductive interference to communication circuits, arising from the balanced voltages and currents, can in a large measure be prevented by means of an adequate system of transpositions applied to both power and communication circuits (assuming the latter are metallic) and located with due regard to each other.*

This is accomplished partly by creating mutually neutralizing inductive effects in neighboring lengths of each side of the communication circuit or circuits by transposing the power circuit, and partly by equalizing the inductive effects on the two

sides of the communication circuit or circuits by exposing each side equally to the influence of the power circuit by transposing the communication circuit.

6. *Abnormal conditions and at times switching operations produce transient disturbances of a very severe character.*

This is due to the fact that abnormal conditions almost invariably give rise to residuals of large magnitude, often including high harmonics. Abnormal occurrences incident to electrical power transmission do not give warning of their occurrence, and since they cannot be produced artificially on transmission systems without subjecting the apparatus to great risk or danger, it has been deemed unwise to attempt any experimental tests of these effects. The conclusion is therefore drawn from general experience and data of actual occurrences collected by the committee.

Rules Recommended by the Committee.

The following are the rules which the committee, as the result of its study to date, recommends be issued at this time to govern the future construction and operation of power and communication circuits which are or are proposed to be so located as to create a parallel as hereinafter defined.

Outline of Rules.

- | | |
|--|--|
| Definitions.
a. Power Circuit.
b. Communication Circuit.
c. Telephone Circuit.
d. Line.
e. Parallel or Parallelism.
f. Residual Current.
g. Residual Voltage.
h. Transposition.
I. Avoidance of Parallelism.
II. Conditions under which Parallelism will be Permitted.
a. Minimum Horizontal Separation.
b. Balance of Power System.
c. Limitation of Residual Currents and Voltages.
d. Transposition Inside Limits of Parallel.
e. Transpositions Outside Limits of Parallel.
f. Uniformity of Parallel.
g. Transformer Connections. | h. Switch Equipment.
i. Switching.
j. Use of Air Switches.
k. Abnormal Conditions.
l. Devices for Indicating Abnormal Conditions on Systems Isolated from Ground.
m. Procedure under Abnormal Conditions.
n. Ammeters in Neutral Ground Connections.
o. Charging Electrolytic Lightning Arresters.
p. Wave Form of Rotating Machines.
q. Exciting Current of Transformers.
III. Provisions Applying to Existing Parallels.
IV. Waiver of Conditions by Communication Company.
V. Parallelism with Alternating Current Railways. |
|--|--|

Definitions.

The following definitions are given of certain technical terms employed herein:

a. *Power Circuit.* The term "power circuit" includes any overhead constant potential alternating current power transmission or distribution circuit or electrically connected network which has a voltage of five thousand volts or more between any two conductors or of three thousand volts or more between any conductor and ground.

b. *Communication Circuit.* The term "communication circuit" includes any overhead, open wire telephone, telegraph, or signaling circuit which is used in the service of the public.

c. *Telephone Circuit.* The term "telephone circuit" includes any inter-exchange metallic telephone circuit, and therefore excludes subscriber's circuits. This term also includes any metallic telephone circuit operated by any railroad or other company for dispatching purposes or for public use between separate communities.

d. *Line.* The term "line" means any circuit or aggregation of circuits carried on poles or towers.

e. *Parallel or Parallelism.* The terms "parallel" or "parallelism" refer to cases where a power line and a communication line follow substantially the same course, or are otherwise in proximity for a sufficient distance, so that the power circuit is liable to create inductive interference in the communication circuits.

f. *Residual Current.* The term "residual current" denotes the vector sum of the currents in the several conductors of a power circuit.

g. *Residual Voltage.* The term "residual voltage" denotes the vector sum of the voltages to ground of the several conductors of a power circuit.

h. *Transposition.* The term "transposition" denotes the interchange of position of the several conductors of a circuit.

I. Avoidance of Parallelism.

Every reasonable effort shall be made to avoid new parallelism. The party proposing to build a new communication or power line, which will create a parallel, or generally to reconstruct an existing line involved in a parallel shall give due notice (at least thirty days wherever possible) of its intention to the other party, including detailed information as to the location and character of the proposed line. If a plan can be devised and agreed upon by the two parties for maintaining an adequate separation between the two classes of lines so as to avoid interference, this shall be done. In case it is impracticable to secure adequate separation between a power line and a communication line, parallelism will be permitted subject to the conditions set forth in II.

II. Conditions Under Which Parallelism Will Be Permitted.

a. *Minimum Horizontal Separation.* The minimum horizontal separation between the power line and communication line shall be equal to the height of the taller line. The only exceptions to this provision are angle crossings and other unavoidable cases of close proximity, and in all such cases the power line shall be kept above the communication line and constructed in conformity with the National Electric Light Association's specifications for overhead crossings or other approved equivalent which may be agreed to by both companies.

b. *Balance of Power System.* The power company shall exercise due diligence to keep the currents in, and the voltages to ground of, the conductors of any power circuit involved in a parallel, as closely balanced as practicable. In all cases where telephone circuits are involved, special consideration shall be given to the prevention or elimination of harmonics in the residual current and in the residual voltage.

c. *Limitation of Residual Currents and Voltages.* Pending additional rules on specific means other than those given herein, the parties concerned shall endeavor to agree upon the means to be employed for the prevention or limitation of residual currents and voltages, and in the event of disagreement the matter shall be referred to the Railroad Commission of the State of California.

d. *Transpositions Inside Limits of Parallel.* An adequate system of transpositions shall be installed in the lower circuit (or circuits), and in the communication circuit (or circuits) provided the latter is metallic. When both circuits are transposed the transpositions in both the communication and power circuits shall be located with due regard to each other.

Every reasonable effort shall be made by both parties concerned to fix the limits of the parallel and the location of crossings, branch lines, and connected apparatus so as to facilitate the application of an effective transposition scheme.

In the case of a parallel between a power line and a telephone line the company owning or operating the telephone line involved shall have the right to specify the number, type (in respect to electrical characteristics) and location of the transpositions in the power circuit subject to the following limitations:

1. For power circuits of 50,000 volts or over the average distance between successive transpositions shall not be required to be less than one mile and the minimum distance between any two successive transpositions shall not be required to be less than two-thirds of a mile.

2. For power circuits of less than 50,000 volts the distance between successive transpositions shall not be required to be less than one-sixth mile.

The transposition system of the telephone circuits shall be modified where necessary in order that the power and telephone circuits shall be, as nearly as practicable, mutually non-inductive.

For short parallels less than six miles in length (or short sections of longer parallels which have to be treated independently because of abrupt change in conditions) with power circuits of 50,000 volts or over, where it is impracticable to obtain an adequate balance by the location of transpositions in accordance with the limit specified above, the company owning or

operating the telephone line involved shall have the right to specify the number, type and location of transpositions provided the distance specified between successive transpositions is not less than one-half mile.

When necessary (due to variations in lengths of telephone transposition sections) in order to secure an adequate balance, a reduction of 10 per cent in the limiting distances between successive power circuit transpositions as given above, shall be allowed.

In the case of a parallel between a power line and a telegraph line or other grounded communication circuit, the location of the transpositions in the power line shall be with due regard to the limits of the parallel in order to form as nearly as practicable a balanced system. The location and type of such transpositions shall be as specified by the communication company, subject to the condition that the transpositions in the power circuit may not be required to be less than one mile apart.

In no case shall the power company be required to relocate poles or towers for the transpositions.

The parties concerned in any proposed parallel shall endeavor to agree upon a transposition scheme for such parallel in accordance with the above. In the event of a disagreement, the matter shall be referred to the Railroad Commission of the State of California.

e. *Transpositions Outside Limits of Parallel.* In addition to transpositions within the limits of a parallel, as provided in "d" hereof, each new power circuit isolated from ground (or extension of such existing circuit) which is constructed subsequent to the date when these rules become effective, shall be transposed throughout its entire length in such manner as to balance the electrostatic capacities to earth of its several conductors, so as to avoid inequalities among the voltages to earth of the several conductors, which would create inductive interference. Such transpositions shall not be more than eight miles apart, provided however, that circuits less than three miles in length are not required to be transposed until they are extended to a greater length; except that extensions or spurs from existing lines, the electrostatic capacities to earth of whose conductors are balanced, shall be so constructed as not to change materially the balance of the existing lines to which they are connected.

f. *Uniformity of Parallel.* To facilitate the application of effective transpositions, both parties shall endeavor to maintain uniform separation, uniform arrangement of conductors and uniform relative location of the two classes of circuits within the limits of a parallel. However, when it is feasible to secure a substantial increase of separation between the two lines for a considerable portion of a parallel, this shall be done, as such an increase of separation is of more benefit than uniformity.

g. *Transformer Connections.* (1) On any power circuit involved in a parallel, no grounded single-phase or grounded open-star transformer connections shall be employed.

(Note: This does not apply to railroads operating alternating current trolleys with ground return, which are covered by V.

- (2) On a power circuit involved in a parallel, no star-connected transformers or auto-transformers with grounded neutral shall be employed, unless delta-connected secondary or tertiary windings or other equivalent means are used of suppressing the third harmonic components of the residual voltages and currents introduced by the transformers.

- (3) Where single-phase loads are connected to a polyphase power circuit involved in a parallel, the power company shall endeavor to arrange successive connections of this type so as to equalize the loads upon the several phases.

- (4) On a three-phase circuit involved in a parallel, the power company shall use, wherever practicable, a closed-delta connection in preference to an open-delta connection, and where the latter is employed an effort shall be made to distribute such connections equally upon the several phases.

h. *Switch Equipment.* A power circuit involved in a paral-

lel shall be equipped, between the source of supply and the parallel, with oil switches, all poles of which shall be mechanically inter-connected for simultaneous action. With the exception of stations where an operator is constantly on duty, these switches shall be rendered automatic for short-circuits, grounds, and abnormal neutral currents.

i. *Switching.* All switching on all parts of a system connected to a circuit involved in a parallel, which causes harmful transient disturbances in communication circuits, shall be done by means of oil switches, all poles of which are mechanically inter-connected for simultaneous operation.

j. *Use of Air Switches.* The use of air switches, on a power circuit involved in a parallel, is prohibited except for purposes of isolating sections of dead line, or for disconnecting transformers under no load. This applies to the entire power system, any circuit of which is involved in a parallel, unless such switching is so remote as not to cause transient disturbances in the communication circuits.

k. *Abnormal Condition.* A power circuit involved in a parallel shall not be operated at any time with an open, grounded or short-circuited line wire or wires or transformer winding.

l. *Devices for Indicating Abnormal Conditions on Systems Isolated from Ground.* If a power circuit involved in a parallel is electrically isolated from ground, reliable indicating devices shall be installed at its source of supply to inform the operator immediately of abnormal conditions, such as grounds and wherever possible, open circuits, which have not operated automatic switches. Upon indication of trouble by such devices, the operator shall immediately open the oil switches and proceed in the manner outlined in "m."

m. *Procedure under Abnormal Conditions.* In case of the opening of an oil switch due to an abnormal condition in a power circuit involved in a parallel, or any circuit supplying or supplied by the same, such switch may be closed once; if opened a second time due to the continuance of the fault or abnormal condition, said switch shall not be closed again until the line has been sectionalized. The fault may then be located by energizing sections of line, provided that further sectionalization of the line be done in such sequence as to cause the minimum disturbance to parallel communication circuits, and provided further that where practicable the faulty section of line shall be energized but once in this process of sectionalization, where the fault exists within or beyond the parallel, until such fault is remedied.

n. *Ammeters in Neutral Ground Connections.* Wherever a neutral ground connection is employed on a circuit involved in a parallel, an ammeter, suitable for measuring as accurately as practicable the current in the neutral under normal operating conditions, shall be installed in all neutral connections at the main generating and substations on the power system electrically connected to the circuit involved in the parallel. The power company shall maintain a record of hourly measurements of the neutral current at all such points.

o. *Charging Electrolytic Lightning Arresters.* Where a power system is equipped with electrolytic lightning arresters so charged as to cause inductive interference in communication circuits the method of charging the arresters shall be modified to eliminate the disturbances as far as possible. The charging of such lightning arresters shall be done at such time as to give the minimum liability of interference with communication circuit operation, preferably between the hours of 2 a. m. and 4 a. m.

p. *Wave Form of Rotating Machines.* The power company shall make every effort to obtain generators and synchronous motors for use on all parts of the system, giving, as nearly as reasonably possible, pure sine waves of voltage at fundamental frequency. In no case shall the deviation from a pure sine wave exceed the limit set forth in the Standardization Rules of the American Institute of Electrical Engineers.

q. *Exciting Current of Transformers.* In order that the wave shapes of voltage and current may be distorted as little as practicable by transformers, the main line transformers employed on circuits involved in a parallel and on future ex-

tensions of such circuits shall have an exciting current as low as is consistent with good practice, and in no case shall the exciting current at rated voltage exceed ten per cent of the full load current. Such transformers shall not be operated at more than ten per cent above their rated voltage.

III. Provisions Applying to Existing Parallels.

The following sections of II shall apply also to power circuits involved in existing parallels: b, i, j, k, l, m, n, o, p, and q. Also g-3 and g-4 shall apply to existing parallels to the extent that transformers added hereafter shall be connected as provided in said rules.

IV. Waiver of Conditions by Communication Company.

At the option of the company operating the communication circuit or circuits any of the provisions of II and III may be waived.

V. Parallelism With Alternating Current Railways.

It is recognized that railroads operating alternating current trolleys with ground return create serious inductive interference with parallel communication circuits. In the present state of the art, no means for completely overcoming inductive interference from such parallels is known, hence, they are to be avoided if possible and where unavoidable, the responsibilities arising therefrom must be settled by mutual agreement or in case of inability to agree the matter shall be referred to the Railroad Commission of the State of California.

Discussion of Rules.

It will be noted from the definitions that the terms "power circuit" and "telephone circuit" are used in these rules in a special, restricted sense.

(I) The first and most obvious means of preventing inductive interference is to avoid the close association of power and communication circuits. Further, it is recognized that in no other way can complete freedom from interference be secured. While with the ever increasing network of electrical circuits of all kinds, adequate separation to avoid interference is becoming increasingly difficult to maintain, the Committee feels that the importance of such separation justifies its being made the first premise in rules designed to prevent inductive interference.

Notice, sufficiently in advance, should be given the other party or parties concerned in any proposed parallel in order that thorough consideration may be given by both parties to possible means of avoiding the parallel, or, in case the parallel cannot be avoided, to the necessary remedial measures to be employed.

(II-a) The best insurance against physical hazard in cases of close proximity is to maintain a separation equal to the height of the taller line, thus avoiding the possibility of physical contact in case of failure. In the case of crossings and unavoidable cases of close proximity for short distances extra-strength construction is necessary as a precaution against failure.

(II-b) As has been pointed out under the heading "Results Accomplished," and more fully explained in Appendix II, residual voltages and currents are particularly troublesome factors in causing interference. Means to eliminate or reduce such residuals in power systems are highly important and while information at this time does not enable the committee to formulate as explicit a rule as is desirable, yet the importance of the subject justifies its inclusion in the rules. The acquisition of further information on which to base a more explicit rule upon this subject is a most important problem, the experimental study of which is discussed in the following section of this report.

(II-d) Transpositions properly located in both power and communication circuits offer the most reliable and effective means for preventing interference from balanced voltages and currents of power circuits. While the inductive effects increase in severity for the higher voltage circuits, due in part to the increased separation of the line conductors, which renders more frequent transpositions desirable, the mechanical difficulties involved are so great as to over balance the other reasons and the rules, therefore, provide for less frequent transpositions in

the higher voltage circuits than in the lower voltage circuits. A further reason for frequent transpositions in the lower voltage circuits is the necessity of a flexible system of transpositions applicable to short parallels which generally occur with such circuits.

(II-e) The provision requiring transpositions outside the limits of a parallel on systems electrically isolated from ground is an explicit measure for carrying out the purpose of the more general provision given under II-b-c, "Balance of Power System" and "Limitation of Residual Voltages and Currents."

(II-f) Non-uniformity of separation and type of construction within the limits of a parallel are inequalities which cannot in many cases be taken into account in the design and layout of transposition schemes. Such inequalities tend to nullify the effectiveness of the transpositions; hence, it is desirable that they be avoided. A precautionary statement is included in the rule in order that the possibility of securing a wide separation for a considerable portion of a parallel may not be sacrificed for the sake of absolute uniformity throughout the entire length.

(II-g) Some types of transformer connections and methods of operation give rise to large residual voltages and currents and certain provisions of the rules are designed to prohibit or restrict the use of such connections and methods of separation. These rules may be considered as explicit provisions complying with the general provision in II-b-c, "Balance of Power System" and "Limitation of Residual Voltages and Currents." The sufficiency of these specific provisions as an insurance against harmful residual voltages and currents is subject to future determination.

The present information of the committee does not warrant the definite recommendation of any one type of connection or method of operation as best from the standpoint of inductive interference. This is true as to the relative merits of the two general types of systems, the grounded neutral and the isolated system. The advantages and disadvantages of these general types and any modifications of these types are dependent upon their inherent characteristics in respect to residuals and the limitations and control of residuals under both normal and abnormal conditions. Both types are on an equality with respect to the interference caused by balanced voltages and currents.

(II-k) Continued operation under certain abnormal conditions is possible in some power systems. In particular, it is possible to operate a grounded star-connected system with one phase open, and it is possible to continue the operation of an isolated system when one phase becomes grounded accidentally. The former gives rise to a large residual current and the latter to a large residual voltage, both of which are liable to render parallel communication circuits inoperative. For these reasons the rule prohibits such operation, which, aside from the consideration of inductive interference, does not constitute good practice in power system operation.

(II-h-l-n) To provide that operation under the abnormal conditions mentioned above may not continue without the knowledge of the power company, the rules specify that devices for indicating grounds shall be installed on isolated systems. With respect to grounded star-connected systems, the rules specify with certain exceptions the automatic opening of switches by abnormal neutral currents. In such systems ammeters are required in all main neutral ground connections. Such ammeters, read regularly, afford means of detecting abnormal neutral currents and are of value in showing the degree of balance of the system, as the neutral current is easily affected by unbalanced conditions.

(II-m) Accidental causes give rise to occasional abnormal conditions. These can only be guarded against by good construction and maintenance and careful operation which, however, cannot prevent entirely such occurrences. When trouble develops on a power circuit involved in a parallel, it is always liable to cause serious interference to the communication cir-

cuits, if the exposure is severe. In the present state of the art, the method of fault location on power circuits is a process of repeated sectionalization and energization of the faulty line until the fault is located within certain limits. This process causes repeated interruptions with loss of time in the operation of the communication circuits, and in the case of telephone circuits is accompanied sometimes by injury to the operators. It should be explained that the loss of time is much greater than the duration of the disturbance, owing to the time required to restore the protective devices on the communication circuits to their normal condition. No method of locating faults on power circuits is known which meets the requirements of practice and yet avoids the disadvantages of the present method. The inductive disturbances due to fault location can be to a considerable degree ameliorated by disconnecting the faulty line from the rest of the system and energizing this line by a single generator at such excitation as may be necessary to overcome the insulation of the fault. Whenever practicable this method is employed by power companies; hence, it has not been thought necessary to cover it by a specific rule.

In view of these facts, the committee is recommending the limitation of the present practice in this regard so as to avoid, as far as seems practicable, the repeated interruptions to communication circuit operation. It is highly desirable that some better method of fault location be developed, not only because of the attendant consequences of the present method on communication circuits, but also because of the abnormal strains to which the power apparatus is necessarily subjected.

(II-h-i-j) Normal switching operations on power circuits produce at times severe transient disturbances in parallel communication circuits. The commonly recognized fact that oil switches produce less severe transient disturbances in power circuits, affords the basis for the provisions in the rules dealing with switches and switching. The automatic features required are designed to prevent continued operation under abnormal conditions.

(II-o) Transient disturbances of severe nature to telephone circuits are sometimes caused by the charging of electrolytic lightning arresters. There are available methods of diminishing the transients due to this cause, and a general provision to the effect that such methods shall be employed when necessary, is included in this rule. It is further provided that the charging of the arresters should be done at times when the telephone circuits are least used.

(II-p-q) Fundamentally, interference to telephone circuits by power circuits in normal operation is largely due to the existence of harmonics in the currents and voltages. While the complete elimination of these harmonics seems impracticable, still beneficial results may be obtained by practical efforts in this direction and the committee feels that the two general provisions as to the wave form of rotating machines and the exciting current of transformers are of great importance both from a practical standpoint and also as enunciating a general principle. The matter of generator wave form particularly is of importance for all types of systems. The provision with reference to the exciting current of transformers, while desirable in all cases, is particularly so on grounded star-connected systems.

(III) Certain of the measures in II, particularly those referring to power system operation, which are helpful in mitigating inductive interference, have been recommended to apply to existing parallels.

(IV) Since these rules are designed for the protection of communication circuits, it is proper that the companies operating such circuits be given the right to waive any measures of protection which they may in any particular case consider unnecessary.

(V) The committee has undertaken no investigation of cases of parallelism with alternating current railways, but as the seriousness of this class of exposure is recognized it was thought desirable that it be referred to specifically.

[To be continued.]

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In an address to an assemblage of National business men a short time ago Mr. F. A. Vanderlip said:

What is the Effect

"We must recognize the probable effect of present day political tendencies upon business, upon property rights, and upon the course of industrial and commercial development. I believe that currents are developing today that may quickly become irresistible forces, and that, too, forces of adversity and ill fortune, if their dangers are not comprehended, their direction corrected, and their sources controlled."

There is no man's business so humble that his interest in it is not as great and as important to him as the largest industries of the country are to the men who control them and to whom this warning was given. A city is a community of individuals and its commercial life an aggregation of small units each of which should be not only fostered and encouraged but protected by the body politic. The "Journal" is, as its readers know, a technical publication conducted in the interests of the electric and gas industries of the Pacific Coast and it would be recreant to itself and its duties to them if it did not register a protest when it sees even a small unit of these industries being unfairly dealt with. While we have no quarrel with a municipality that concludes that it is good business to conduct its own public utilities, yet we feel in doing so the operation of those utilities should be limited and conducted in such a way that they will not work a hardship on any of the citizens who contribute to the support of that utility by using its product or pay in taxes for its installation and support. To give a specific instance of this we will recite the municipal electric plant in the city of Alameda, the commissioners of which have established and are conducting a municipal store for the sale of goods such as lamps, heating devices and current consuming apparatus. There were in Alameda prior to the establishing of this municipal store several citizens and taxpayers whose sole and only business was and is the sale and installation of such articles and who we understand pay a license for the privilege of conducting such business. True, they were not large, but extensive enough for the trade and were growing with the industry.

Now comes the municipal store, competing with these dealers, selling the same class of goods at cost, goods that are purchased in part by the money they pay to the municipality in taxes and licenses and their business is taken from them, and they must either move out, go into other occupations or starve.

It needs no argument to prove that any establishment selling goods at cost without adding thereto the cost of operating, must be an expense to the persons who own it, and in this case it being the people; we would ask if the public really know what the financial results are.

There are two arguments used in favor of this municipal merchandising policy, one being that the

taxpayers, who own the store, get their electrical goods at cost. In answer we will venture the assertion that those who use the current and buy the goods pay more in taxes because of the expense of operating this store, than they save by cutting out a dealer's profit. And how about the taxpayers who do not use electric current? Suppose a municipality should follow this rule regarding all requirements of its taxpayers. Would it not soon eliminate all business houses?

The other argument is that they want to encourage the use of current consuming devices to create a load and especially a day load which is always desirable. We venture the further assertion that the few cents difference in price which would be the legitimate profit of the dealer over the cost price at which the municipal store sells would not deter one purchaser out of one hundred who wanted the article. And we venture the still further assertion that a little co-operation between the municipal plant and the electrical dealers of Alameda would result in adding more consumers and consuming devices to their lines in three months than the municipal store selling at cost will in one year.

When people played the organ with their fists, when they could multiply only with the multiplication table before them, when hands did what is now done by heads, time and labor were of little consequence. Now, however, anything that saves time or work is no longer a luxury but an absolute necessity.

The judicious use of the telephone is a great saver of time, and consequently it is fast becoming indispensable. Likewise its injudicious use, such as by the stenographer during the noon hour, is a waste of time, but this is extraneous. Man's gregarious instinct is cognate with that of self-preservation, and it is satisfied by the telephone, whether in the case of the housewife in the city flat or the rancher in his lonely cabin.

Although the increase in its use has been great, yet there remains a demand for its services which existing companies cannot supply. There is still so much to be done that it seems futile to engage in internecine quarrels. The public wants service and cares little by whom it is given, so long as it is good. There never was a time so favorable for telephone development, nor is its field so limited as to shut out competition.

Competition, in its better sense of emulation, gives better service. It may even become co-operation in extending service, rather than opposition in limiting it. "Live and let live" is a better doctrine than "dog eat dog."

The field for the telephone is a broad one and there is ample room for all. A quart flask filled with alcoholic vapor will receive another quart of gasoline vapor without increase in volume, just as a glass tumbler filled with shot can hold a large amount of water

without spilling. This is much like the case of the vegetable man who sells five bushels of big potatoes and one bushel of small ones from his original five bushel basket. With so many fields as yet undeveloped, however, there should be no necessity to duplicate lines except where public opinion demands better service or a better rate.

At a meeting of independent telephone men it was the consensus of opinion that there is a greater demand for telephone service than existing organizations can supply and that the plan of the independents will be to offer good service at fair rates and let competition take care of itself. We have often spoken of the great strides being made by independent telephone companies on the Pacific Coast.

By easement we refer to a curve in engineering design to avoid any sudden change in the direction or acceleration of moving masses.

Business Easements

It is the process that gives gradual guidance to minimize the shock resulting from change in mass motion. Such is the transition curve in a railway track, which lessens the force of impact in passing from a tangent to a turn. The dash-pot of a steam engine is likewise intended to eliminate vibration in the machine parts. Hydraulic pipe lines are constructed with easement curves to connect straight runs to circular arcs. The guiding vanes in pumps and turbines are but easement curves. Recent experiments have proved that even the flexibility of electric transmission would theoretically require the absence of sharp turns, as otherwise there is an appreciable loss of power in sudden bends.

The theory of easements seems to be but a part of the great laws of Nature that recognize the inefficiency, if not the impossibility, of a cataclysm. We see this law exemplified in the long continued detrital accumulation that builds the sand bars, and in the accumulative accretion that develops animal and plant life. Even the cataclysm is due to slow and gradual, but incessant, changes that ultimately seek violent vent, unless easement is provided.

A great invention, that appears to come with the suddenness and the brilliancy of an unpredicted comet, has been a long time materializing in the minds, not only of the inventors, but of many others before, who have provided the forgotten curves of easement.

In business, as in mechanics and Nature, there are certain easements that make smooth its course. The home and school training of a lad are but the easement curves that prepare him for the buffetings of business. The polish possessed by one from whom the crudities and rough edges of individual personality have been worn is an easement curve of success. Tact in the telephone man, or diplomacy in the central station manager are the easements that smoothly guide a business through industrial turmoils. A business conducted in obedience to these principles, like a ship of good "lines," will make better progress and avoid the shocks which come from abrupt changes.

PERSONALS

Chas. W. Forbes, general manager Compania Telefonica de Sonora, Mexico, is a recent arrival in San Francisco.

Kingsley G. Dunn, vice-president Hunt, Mirk & Co., Inc., left for a short trip throughout the southern part of California.

Henry A. Lardner, vice-president J. G. White Engineering Corporation, returned from a business trip throughout the East.

Alanzo C. Gartley, formerly manager of the Hawaiian Electric Company, is stopping at the Palace Hotel, in San Francisco.

Chas. A. Rolfe, general manager of the Southwestern Telephone Company at Redlands, California, spent several days during the week in San Francisco.

R. D. Stone, general manager of the Hawaiian Telephone Company, Hilo, T. H., spent several days in San Francisco, en route to Los Angeles, California.

W. L. Goodwin, vice-president of the Pacific States Electric Company, San Francisco, spent the week on a motor trip through the Tahoe region, California.

Frank E. Smith, Pacific Coast manager Weston Electrical Instrument Company, returned from a business trip throughout the La Grange district, California.

H. M. Hepburn, formerly manager of the Hawaiian Electric Company, Honolulu, has decided to remain in California, and has opened an office at San Francisco.

George J. Henry Jr., representative for the Western part of the United States for the Mannesmannrohren-Werke Company, has left on a business trip through Nevada and Plumas Counties.

H. A. Noack, president of Pierson-Roeding & Company, San Francisco, left last Saturday for Spokane to attend the Pacific Coast meeting of the American Institute of Electrical Engineers.

Henry F. Holland, western representative of the Simplex Electric Heating Company, has returned to his headquarters in Salt Lake City after three months spent in covering the coast territory.

Geo. R. Murphy of Pierson-Roeding & Company, San Francisco, returned Thursday from the East, where he has been for the past month visiting the Electric Storage Battery Company's factory.

Wilford Clyde has resigned his position as superintendent of the municipal plant at Springville, Utah, to accept a position in the commercial department of the Utah Light & Railway Company, Salt Lake City.

E. M. Cutting, representative of the Edison Storage Battery Supply Company, San Francisco, returned the first of the week from Reno, Nevada, where he addressed a meeting of electrical engineers at the State University.

W. S. Heger Jr. left for St. Louis last week to be present at the assembling and tests of the great engine the Busch-Sulzer Bros. Diesel Engine Company are to install at the Panama Pacific Exposition. He expects to be at the works for two months.

K. E. Van Kuran, assistant district manager of the Southern California offices of the Westinghouse Electric & Manufacturing Company, Los Angeles, left for the East last week to attend the district managers' convention at Virginia Hot Springs, Va.

A. G. Jones, engineer with the General Electric Company, San Francisco, gave an address on Locomotive Headlights before a representative gathering of engineers and managers of interested companies during the week at the University of Nevada, Reno, Nev.

S. W. Russell, former district freight and passenger agent Sacramento for the Northern Electric Railroad, has been engaged to fill a similar position with the Oakland, Antioch & Eastern. He will assume his new duties immediately, directing the activities of the road from Sacramento.

City Electrician Manahan of Los Angeles is visiting eastern cities to study fire alarm and police telegraph systems with a view to determining what is best for installation in that city. The city council has appropriated \$450 for this trip and the board of public works has granted Mr. Manahan forty days' leave of absence.

W. A. Kraner, engineer and contractor, Chamber of Commerce, Portland, lately returned from Utah, where he was called in a consulting capacity by the Utah Light & Power Company, in the matter of the installation of a riveted steel pipe-line 2000 feet long and 16 feet in diameter, on the Bear River, near Preston, Utah.

Curtiss B. Hawley, general manager of the Inter-Mountain Electric Company, left this week to attend the quarterly Electrical Jobbers Convention to be held at Niagara Falls September 9th, 10th and 11th. He will stop over while there to attend the convention of the Westinghouse Lamp agents which commences on the 12th.

J. Sandberg and **Thos. B. Culhane** of the sales force of the Salt Lake office of the General Electric Company, have left for extended trip in the east. Mr. Sandberg will visit his home in Chicago and at St. Louis, Kansas City, Denver and other General Electric offices for the purpose of familiarizing himself with sales methods at other points. Mr. Culhane, who is in charge of the local sales force, will visit the company's factories at Schenectady, Pittsfield, Lynn, Harrison, and Cleveland.

OBITUARY.

Henry H. Sinclair, noted hydroelectric engineer and a controlling factor in electrical engineering fields, passed away at his home in Pasadena, California. Mr. Sinclair was intimately associated with many of the power concerns in his section of the state and at one time was vice-president of the Southern California Edison Company, the Redlands Electric Light & Power Company and the Great Western Power Company.

John M. Frink died of heart failure at his summer home at Seattle, Washington, on the morning of August 31st. He and associates organized the Seattle Electric Company. The deceased was noted for his liberality in behalf of the city. In October, 1906, Mr. and Mrs. Frink donated to the park board twenty acres of land lying on the Lake Washington slope, valued at \$60,000. As a member of the park board he fought for the extension and preservation of the present system. Deceased was born in Susquehanna, Pennsylvania, 69 years ago, and came to Seattle in 1875. He leaves a wife and five children.

NEVADA'S SAFETY FIRST LABOR DAY EXERCISES.

Under the direction of Professor J. G. Scrugham of the University of Nevada a series of most interesting and instructive mine rescue and first aid exhibitions and contests were held on Labor Day at the University grounds, Reno, Nevada. During the morning papers were read and address made before the Engineers' Club on various engineering topics by prominent speakers. The afternoon was devoted to the "mine rescue" and "first aid" contests. Nine "mine rescue" teams were brought from various mining regions of the State, while fifteen different teams participated in the "first aid" contests, the entire programme being one of much enlightenment and interest, not only to those directly interested, but the general public, which was an interested spectator.

The celebration closed with a banquet in the evening, given by the members of the Engineers' Club of the University of Nevada.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Northern California Power Company has filed an application asking authority to issue promissory notes in the sum of \$22,000 for the purpose of refunding notes outstanding.

The commission has dismissed the application of the Southern California Edison Company for authority to issue 30,000 shares of common capital stock of the par value of \$100 each, at the request of the company.

The commission has issued a supplemental order authorizing the Los Angeles & San Diego Beach Railway Company to issue two promissory notes totaling \$34,000, to be used in renewing similar notes outstanding.

The commission has issued a supplemental opinion approving the form of a trust deed submitted by the Sonoma Valley Water, Light & Power Company to be used in securing a bonded indebtedness of the face value of \$30,000. At the hearing, the Sonoma City Water Works Company protested against the issue of bonds by which the Sonoma Valley Company will be enabled to extend its system in the city of Sonoma. The commission held that no valid reason existed for denying to either company the right to make extensions within the city limits.

The commission has rendered a decision reducing the general lighting rates charged by the Coast Valleys Gas & Electric Company in the city of Salinas, Monterey county, from 10c for the first 50 kw.-hr to 8c for the first 20 kw.-hr. The commission also fixed a minimum meter charge of \$1 per month and a service charge of \$1. The latter charge will be required of all applicants for service but will be refunded if the consumer remains for 12 months in one location. The rates for municipal street lighting were also found to be excessive. Henceforth the city will pay 10c per year per watt connected instead of the present rate of \$7.50 per month for each arc light. The commission made no changes in power rates but established a rule that the consumer should have the option of combining power of less than 3 h.p. with lighting at the lighting rates or of requiring separate power and lighting meters for each class of service. The company was given the privilege of supplying either single or 3-phase current to power installation of less than 3 h.p.

NEWS OF THE ARIZONA CORPORATION COMMISSION.

The Mountain States Telephone & Telegraph Company has been given until September 15, 1914, within which to submit to the commission a proposed plan or proposed rates for telephone service in and around the precinct of Meridian, Maricopa county.

The commission has granted a certificate of convenience and necessity to the Winslow Gas Company for the purpose of exercising the rights and privileges in the matter of the operation of a gas plant at Winslow, Arizona, in connection with the franchise granted the gas company by the town of Winslow.

The application of the Phoenix Railway Company of Arizona to construct an extension of its Brill Line from its present terminus in the City of Phoenix to the city limits in Phoenix at McDowell Road and thence northerly for a distance of about 5-8 of a mile to Sheridan street in Syndicate Place, has been granted.

TRADE NOTES.

The Westinghouse Lamp Company was awarded the \$10,000 lamp contract for the state building at Sacramento.

The Westinghouse Electric & Manufacturing Company has received from the Third Avenue Railway Company a repeat order covering twenty-five PK control equipments for use on their low floor 24 in. wheel car.

W. H. Smith Electric Engineering Company has the contract for installing the power equipment for Municipal Dock

No. 1, Portland, Oregon. This contract includes all the wiring necessary for the operation of the power system.

W. A. Kraner & Company, engineers, Portland, are looking after the engineering and construction for the Snow Mountain Water & Power Company, Ukiah, Cal., in connection with certain changes and reconstruction of the plant.

The Westinghouse Electric & Manufacturing Company has received from the New York Municipal Railway Corporation an order for one hundred sets of ABF control equipment to apply to the second hundred new steel cars which will be used in the new subway. This is a repeat order for the first hundred cars, which cars were fully described in the technical papers.

No less than sixty or seventy members of the office staff of the British Columbia Electric Railway Company have been called out on active service and have left for the front. Although this condition exists throughout Canada it is not to be taken as indicating that there are as a consequence a large number of vacancies to be filled. The various central station companies are inclined rather to reduce their staffs still further than to add to them for some time to come.

Eardley Bros. of Salt Lake City have recently installed 13-750 watt Type C Mazdas for the Boston Store, the principal dealers in ready to wear clothes for women. They have also secured the contract for the electric fixtures in the new Broadway motion picture house which will soon be opened. Special semi-indirect light fixtures are used throughout the designs being made to harmonize with the interior architecture and decoration of the theatre.

The Electrolytic Gas Company, operating three plants for the generation of oxygen and hydrogen for use in manufacturing, has decided to locate a fourth plant in Portland, Oregon, the first three being at Dayton, Ohio, (the home office), Toledo, Ohio, and Davenport, Iowa. A site has been purchased in Portland at the corner of Center and Seventeenth street, and bids have been asked for the erection of the plant. E. A. Finkbeiner will be manager of the Portland plant.

NEW CATALOGUES.

Advertising that helps dealers' sales is the subject of a collection of typical display advertisements recently used in the popular magazines by the Westinghouse Electric & Manufacturing Company.

Condensite is the subject of an interesting pamphlet from the Condensite Company of America, Glen Ridge, N. J., manufacturers of a new insulating material which can be moulded in hard shapes.

Bulletins No. 102, on Piston Pattern Pumps, and No. 103, on center Packed Plunger Pumps, manufactured by the Epping-Carpenter Pump Company of Pittsburgh, Pa., has been received by their representatives on the Pacific Coast, Hunt-Mirk & Co., San Francisco.

Telephone Cords is the subject of an instructive catalogue from the Western Electric Company. The details of construction and care of many kinds of cord are fully illustrated and described. This company is also distributing an interesting catalogue on Magneto Telephones and Supplies, which shows every piece of material necessary in the installation of rural or town service.

Manhattan Electrical Supply Company of New York, Chicago, St. Louis and San Francisco are distributing an illustrated catalogue of "Mesco Products," manufactured by them. These include telephone and telegraph apparatus, wire and wireless, push buttons, annunciators, bells, batteries, automobile supplies and many small electrical specialties. The great number and variety of these products is indicated by the fact that 286 pages are required for their illustration and description.

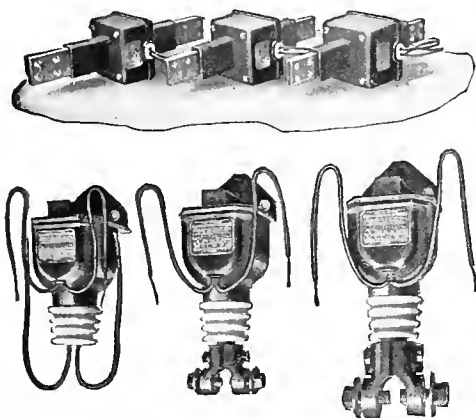


INDUSTRIAL



NEW WESTON INSTRUMENT TRANSFORMERS.

Two new bulletins announcing and describing switchboard and portable instrument transformers have just been issued by the Weston Electrical Instrument Company of Newark, N. J. It has been recognized that instrument transform-



Weston Models 336 and 289 Switchboard Transformers.

ers should be designed and made with greater refinement than is necessary in commercial lighting and power transformers.

These new contributions to the art of electrical measurement by the Weston Company represent the results of several years' careful and most thorough analytical study and experimental investigation of the many factors involved in developing and making instrument transformers capable of giving the highest degree of precision under the widely varying conditions incidental to their practical use.

Two different models of portable current transformers are listed. One type has three self contained primary windings and the other is of the inserted primary type, the ratio depending upon the number of turns of the primary that are passed through the aperture. There is also a portable potential transformer which is made in various ranges.



Weston Model 312 Portable Current Transformer
With Self-Contained Primary Winding.

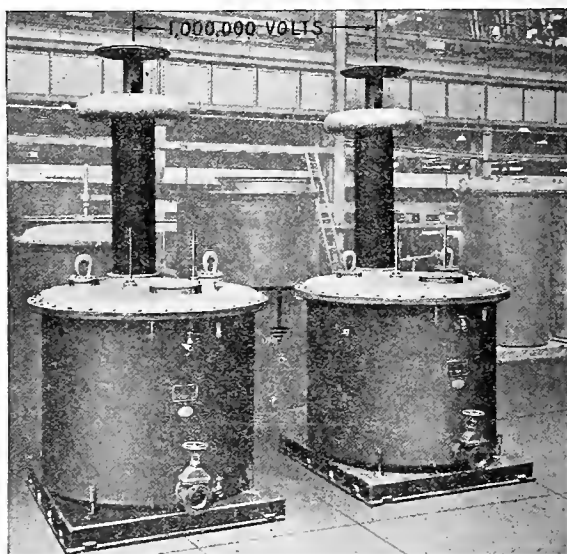
The switchboard models are made in several different types which vary in appearance with the ratio, the volt-ampere capacity and with the potential of the circuit. The manufacturer emphasizes the point that these transformers are unequalled in precision, in design, in workmanship and reliability in service.

Indeed, special stress is laid upon the accuracy, the ratios of transformation, and upon the fact that the design and proportions of the transformers are such that it is unnecessary to have instruments specially calibrated with the transformers in order to obtain the degree of accuracy to which high grade instruments are guaranteed when used without transformers.

This feature is of special interest in connection with tests with portable instruments, because in many quarters the impression has prevailed that no transformers could be made that would assure the users of the degree of accuracy for which a high grade portable instrument is designed, unless special precaution had been taken to calibrate a particular instrument with a particular transformer.

TESTING TRANSFORMERS SHIPPED TO JAPAN.

The accompanying illustration shows two testing transformers, having a normal rating of 360,000 volts continuously, and 500,000 volts for short periods. These transformers were recently furnished the Inawashiro Hydroelectric



Testing Transformers of 500,000 Volts Rated Capacity.

Power Company of Japan, one to be installed in the generating station on the Nippashi River at the outlet of Lake Inawashiro, about 145 miles from Tokio; the other in the receiving substation at Tokio, where they will be used for testing transmission lines and apparatus in the stations.

The design features of interest in these transformers are: the arrangement of the windings to give distributed static fields; the use of condenser terminals to give distributed stresses from terminals to ground; and the terminal "hat" to distribute stresses from terminal tip to ground. The transformers are 19 ft. high from base to top of terminal and the tanks are 9 ft. high and 9 ft. diam. One high-tension terminal of each transformer is grounded to the core and case, the other being brought out as shown in the illustration. By connecting the cases of the two transformers as shown one million volts can be developed between the two high-tension terminals.

These transformers were built by the Westinghouse Electric and Manufacturing Company, and are similar in construction to the 500,000 volt testing transformer built by this company.



NEWS NOTES



INCORPORATIONS.

SANTA CRUZ, CAL.—Mountain Light & Water Company, \$25,000, by J. F. Hughes, M. J. Russel, G. L. Stillwell.

SACRAMENTO, CAL.—Sacramento Electric Company, \$50,000, subscribed \$3, by F. V. McAvoy, H. F. Yost, D. Fitzsimmons.

SANTA ANA, CAL.—Huntington Beach Water Company. \$150,000 by R. V. Rhoddes, H. Levinson, J. S. Lawshe and H. L. Heffner, all of Los Angeles.

ILLUMINATION.

DALY CITY, CAL.—A plan will be submitted in the near future for the entire reconstruction of the lighting system.

COLUSA, CAL.—Bids are being taken for the installation of lights for the Princeton lighting district.

PORTOLA CAL.—R. B. Young, president of the Grizzly Electric Company has purchased machinery and equipment for an electric light and power plant for which the company has been given a franchise here.

LOS ANGELES, CAL.—Authorization for the creation of two new lighting districts has been made by the county board of supervisors. The new districts will be known as Newhall and Lancaster lighting districts.

RIVERSIDE, CAL.—No protests against the proposed 3-light ornamental lighting system on Seventh street having been made or on the improvement of New Magnolia Avenue from Terraxina drive to Jurupa Avenue, these two improvements will proceed at once.

SACRAMENTO, CAL.—The city commission has set September 22d as the time for hearing protests in relation to the erection of standards on which will be installed 150 watt drawn-wire tungsten lamps, with the necessary conduits, and appliances, in lighting district No. 6.

REDWOOD CITY, CAL.—The trustees of Redwood City have voted to grant the Pacific Gas & Electric Company permission to build a gas storage plant on the company's property at East Marshall and Washington streets. The application for a permit was strenuously opposed by the residents of the vicinity.

IDAHO FALLS, IDAHO—The new thousand horsepower unit recently installed in the city municipal power plant was put into operation August 30th and as a test the complete lighting and pumping load for the city was cut in, the unit carrying the load well. The recent installation in addition to the units formerly installed, gives the city sufficient power for ordinary use and for all emergencies, a total of 1500 horsepower.

OGDEN, UTAH.—Refusing to accept the company's proposition to open one-half of the street, the city commissioners on August 27th authorized the city attorney to institute legal proceedings against the Utah Light & Railway Company for possession of Spencer street, on which the corporation is alleged to have constructed a gas holder costing \$375,000. The alleged unlawful obstruction of the street has been a matter before the city commissioners for the past two years, a previous administration having received the first complaint from property owners in the vicinity of Twentieth street and Lincoln avenue.

SACRAMENTO, CAL.—At a meeting of the various committees of the Sacramento Retail Merchants' Association, the committee appointed to secure a lower light and power rate reported the companies serving power and light locally had agreed to re-establish the old 2½c rate per kw.-hr. for street illumination, but the companies refused to make any reduction of the 6c rate for interior lighting. The committee was

instructed to continue its efforts for a lower interior rate, and to investigate also the cost of erecting a steam plant and to determine whether the association would erect a plant of its own and supply electrical energy at a 4c or lower rate.

BOISE, IDAHO.—An agreement has been entered into between the city and the Standard Engineering Company, whereby the new street lighting system will be tested and should everything prove to be in satisfactory condition it will be burned regularly hereafter. This special street lighting system which has met with several vicissitudes, consists of four ampere General Electric inverted type luminous arc lamps mounted on ornamental posts. Practically the entire commercial district of the city has been covered with the system, with posts on each side of the street. Installation was made under the general public improvements law of Idaho under which the cost of the system is assessed against the abutting property owners. Under keen competitive bidding the Idaho Railway, Light & Power Company made a contract with the city to light these posts at the rate of \$11.24 per lamp per year including maintenance. This company later passed into the hands of a receiver and the receiver applied to the court for relief from the contract on the grounds that to supply this service at the price named would subject the company to a loss which would fall directly upon its creditors. The relief was granted by the court. In the meantime the system which had been completed for several months remained dark. Later a contract was entered between the city and the Idaho Power & Light Company, a competitor of the former company under which the city purchases the energy for operating the system at the rate of 1c per kilowatt hour and attends to the maintenance and operation of the system itself.

TRANSMISSION.

YUBA CITY, CAL.—An agreement has been entered into between Reclamation District No. 1001 and the Pacific Gas & Electric Company, whereby the latter will furnish power for the pumping plant of the district.

UKIAH, CAL.—W. A. Kraner & Company, engineers of Portland are looking after the engineering and construction for the Snow Mountain Water & Power Company, in connection with certain changes and reconstruction of the plant.

QUINCY, CAL.—The California Water Power Commission has granted permission to the Engels Copper Mining Company which is operating extensive copper deposits in Lights Canyon near Taylorsville, to develop an electric power proposition on Lights Creek, using 60 second feet of water. The power will be used in operating machinery at the mine.

LOS ANGELES, CAL.—Interpreting words "acquire" and "construct" as broad enough to include completion of an existing thing, as applied to aqueduct and acquisition and construction of a power plant, Judge Hewitt has sustained the demurrer of the city to the injunction complaint of Frank E. Hartigan, asking that the city be enjoined from proceeding further with the issuance and sale of \$6,500,000 power bonds.

CARRIZOZO, N. M.—Negotiations are now pending with the Wild Cat Mining Company of White Oaks, for electric power with which to operate the American mining properties in Nogal canyon, with the possible extension of the line to the Parsons mine, over on the Bonito. The two properties are owned by a company composed of A. B. Graham, H. J. Fulmer Jr. and W. H. Tupper, all of Mishawaka, Ind. The mines are known as the Helen Rae and the American.

WALLACE, IDAHO.—Engineer Geo. H. Potter and Arthur C. Pratt, electrical engineer for the Montana Power Company,

Butte, are now engaged with a crew of men surveying a new high power line from this place to connect with the main line of the Milwaukee railroad at some place near Mullan. The distance of the Dry Creek route is just 20 miles, while by the Prospect Creek-Copper Gulch route it will be nearly 30 miles, which would indicate that there is some ultimate object to be worked out, other than the transmission of power, such, for instance, as an electric line up Prospect Creek to the Coeur d'Alene country.

BOISE, IDAHO—Bondholders of the Idaho-Oregon Light & Power Company will be on hand to bid in the property of that company when it is placed on sale September 30th. So declared W. J. Ferris, receiver for the concern, when asked what would be the effect of the opinion recently handed down by Judge Dietrich of the United States District Court on the local power controversy. Mr. Ferris believes the position of the Idaho-Oregon bondholders is much strengthened by the court's decision. "The court's decision removes all question as to the stability of the Idaho-Oregon," said Mr. Ferris. "Another factor that will add to the strength of its position is the completion of the Oxbow power plant. It will be in operation by September 1, some time prior to the sale."

SALT LAKE CITY, UTAH—Progress is being made in the consolidation of the Utah Power & Light Company and the Utah Light & Railway Company, both with headquarters at Salt Lake City. A special meeting of the stockholders of the Salt Lake Light & Traction Company is called for September 18th for the purpose of considering and voting upon a proposition to consolidate this company with the Utah Light & Railway Company. A special meeting of the stockholders of the Utah Light & Railway Company is called for the same date for the same purpose. The Salt Lake Light & Traction Company was incorporated early in August of this year with O. J. Salisbury as president. It is understood that this company is backed by the same interests which control the Utah Power & Light Company and that this incorporation was affected for the purpose of consolidating this latter company with the Utah Light & Railway Company. Another step toward the proposed consolidation was made when the Utah Power & Light Company presented a communication to the commissioners of Salt Lake City requesting permission to consolidate the franchise granted to the Merchants' Light & Power Company and which it holds by assignment with the Utah Light & Railway Company's franchise. The Merchants' Light & Power Company was organized about three years ago for the purpose of entering into competition in Ogden and Salt Lake City with the Utah Light & Railway Company. The franchise and property rights of this company were acquired by the Electric Bond & Share Company about two years ago when the principal electrical interests outside of Salt Lake City and Ogden in Utah and southern Idaho were acquired and the Utah Power & Light Company formed to take over these interests. General Manager Paul B. Sawyer of the latter company has issued the following statement in connection with the application: "Interests connected with the Utah Power & Light Company propose to acquire the property, rights and privileges of the Utah Light & Railway Company. The acquisition of the property and rights of the Utah Light & Railway Company is not completed, but is still more or less tentative. The Utah Power & Light Company is now the owner of a light and power franchise from Salt Lake, one of the terms of which is that the grantee shall procure the consent of the commission to any consolidation, either direct or indirect, of the business and properties of the grantee with that of any other company in Salt Lake. We have applied to the commission for that consent. The franchise itself is a very advantageous one to the city, in as much as the right of regulation is reserved by the city. Many advantages to Salt Lake and its inhabitants will result from an economical management and control of the properties."

The city commission has indicated its willingness to make the transfer of the franchise in accordance with the request but imply that this will be done only on the condition that a substantial reduction in the rates of electricity for lighting and power services be made in consideration of such transfer. The Utah Light & Railways was organized in January, 1910, as a merger of the Consolidated Railway & Power Company and the Utah Light & Power Company. It controls practically all of the electric lighting and street railway business of Salt Lake City and surrounding towns and operates the electric lighting and power and gas business in Ogden. The capitalization consists of \$1,942,550 common stock, out of an authorized amount of \$6,000,000 and \$3,863,175 8 per cent preferred stock, out of an authorized amount of \$4,000,000. Its funded debt aggregates \$4,821,000. In 1913 the company earned \$2,684,943 gross, \$1,266,090 net and surplus of \$369,800 after deductions of \$896,281 for interest and depreciation reserve. In 1913 dividends of 8 per cent were paid on the preferred and 4 on the common stock. Of the issued stock Oregon Short Line owns \$1,853,600 common and \$3,842,875 preferred. The company operates 141 miles of track and owns 224 cars in addition to its electric distributive systems and the Ogden gas plant.

TRANSPORTATION.

SAN FRANCISCO CAL.—The United Railroads Company has decided to loan money to its employees and to charge 5 per cent a year. Plans are maturing and the company's officers believe that the 5 per cent annual interest charge will be sufficient to cover any losses and the expense of conducting the loan department.

FRESNO, CAL.—President J. B. Rogers and General Manager J. H. Crossett of the Fresno Interurban Railroad announce that they will take up the building of their second unit, extending as far as Clovis, about September 15th. Clovis has granted a 50 year franchise to the road for the use of the city streets, and the management has announced that the road will be ready for operation by the first of the year. The section of the road between Alvina Heights and Clovis is about eight miles in length.

BOISE, IDAHO.—Charging that the owners of the Idaho Railway, Light & Power Company looted the Idaho-Oregon Light & Power Company while they were directors of the latter concern as well as of the first, Judge Dietrich, in the Federal Court, has refused the order of foreclosure sought by the State Bank of Chicago against the Idaho-Oregon Company, the Bankers Trust Company and A. W. Priest and others. The suit is brought to foreclose a trust deed to all the property of the power company given to secure 7000 bonds of \$1000 each. The present controversy involves the status of 825 first mortgage bonds claimed by the Idaho Railway, Light & Power Company. In his opinion, Judge Dietrich takes up the history of the various transactions involved in detail. The suit was brought when, a short time before the decree of foreclosure was issued on the first mortgage bonds, the Priest interests sought to intervene and to prevent the foreclosure, charging that the railway company was trying to wreck the power company and thereby injuring the holders of the first mortgage bonds of the power company.

BOISE, IDAHO.—Suit was filed in the United States District Court August 27th, asking for a verdict, which if rendered, will have the effect of dissolving the Boise-Caldwell-Nampa interurban railway loop. It is entitled the Colonial Trust Company and F. F. Brooks of Pittsburg, against the Idaho Railway, Power & Light Company, O. G. Markhus as receiver, and the Idaho Traction Company. The object of the action is to foreclose on the bonds of the old Boise Interurban Railway Company, which are held by the plaintiffs in the sum of one million and seventy-three thousand dollars, to secure the appointment of a separate receiver for the property for-

merly held by the Interurban Company and ultimately to absolutely divorce what was that company from the balance of the present Boise Valley loop. The complaint sets forth that the bonds held by the plaintiffs are secured by the property that belonged to the Boise Interurban and that when that concern was sold to the Idaho Railway, Power & Light Company it was stipulated that the purchasing company was to maintain the interurban property, replacing it as fast as necessary to maintain it as a going concern. It is charged in the complaint that the purchasing company, which by acquiring the Boise Interurban, the Boise Valley and the Boise Railroad Company affected a merger of all the local electric lines, has not maintained the property of the interurban in such a manner as to protect the bonds held by the plaintiffs. The interurban line is that portion of the loop that reaches Caldwell from Boise by way of Middleton, following the Boise River. The interurban loop now operated by the merger through the Idaho Traction Company was completed some two years ago. At that time there was merged with it the Idaho-Oregon Light & Power Company. For some time past all the properties have been the subject of considerable litigation and all three are in the hands of receivers. It is generally believed that they have been physically able to pay dividends, but that their capitalization has been such as to prevent it.

TELEPHONE AND TELEGRAPH.

SPOKANE, WASH.—By a vote of four to one the city council has passed the new 25 year franchise of the Pacific Telephone & Telegraph Company, which, if accepted, becomes effective 30 days after its passage.

MESA, ARIZ.—Men will be in Mesa shortly to commence work on rebuilding throughout the telephone system of the Mountain States Telephone & Telegraph Company. Construction work will include six miles of cables.

ALBANY, ORE.—The Pacific Telephone & Telegraph Company has appropriated \$5010 for an additional plant, including aerial and underground cable in the western part of Albany and additional equipment for the central office.

VANCOUVER, B. C.—Notwithstanding the supposed business stagnation it is of interest to note that the net gain in telephones installed over the system of the B. C. Telephone Company is 3.1 per cent for the first six months of 1914.

SAN BERNARDINO, CAL.—Material is arriving for the extensive extensions to be made by the Pacific Telephone & Telegraph Company in the northern end of the city, also in the southwestern section. A large quantity of cable is to be strung.

LOS ANGELES, CAL.—An ordinance has been adopted by the county supervisors granting to the Whittier Home Telephone & Telegraph Company, a franchise to maintain telephone and telegraph system along certain public highways in the county.

SUMAS, WASH.—At a meeting of the directors of the Farmers' Mutual Telephone Company it was decided to extend the trunk line out the state aid road to give direct service between Sumas and Bellingham. J. A. Lochbaum of Sumas is vice-president of the company.

PORTLAND ORE.—It is stated that the Pacific Telephone & Telegraph Company is preparing to string an additional copper circuit between Seattle and Portland to consist of two copper wires, weighing 435 lbs. per mile, or aggregate of 156,600 lbs. copper wire. The estimated cost of the preliminary work is \$35,000.

BELGRADE, MONT.—The Springhill Telephone Company has filed articles of incorporation for the erection and operation of a telephone line to begin at Belgrade in Gallatin county and to extend in a northeasterly direction to Springhill in Gallatin county. Arthur E. Cramer, J. A. Farwall and J. C. Miller are local directors.

IMPERIAL, CAL.—The Imperial Telephone Company has announced that improvements and extensions of its telephone system throughout the rural districts to the extent of \$50,000 is planned by the company for immediate future. Exchanges are to be established at Seeley, Calipatria and Niland. The company also contemplates doubling of the toll line capacity between the towns.

CHEHALIS, WASH.—The Lewis county commissioners have granted a franchise to the Farmers Independent Telephone Association of Salkum to operate over roads between Mossy Rock and Chehalis. Hearing will be held September 10th on the application of the Little Kentucky Telephone Company to operate south from Toledo to the county line and the Military & Hill Telephone Company for a franchise to operate around Napavine. The Independent Electric Company has applied for a franchise for a power line over the county road from Winlock to store of Cowlitz Prairie and thence to Toledo.

WHITTIER, CAL.—Improvements and additional equipment that will cost \$10,000 and will eventually add nearly 50 per cent to the capacity of the plant have been announced by A. Wardman, manager of the Whittier Home Telephone Company. Part of this equipment is already on hand and the installation will be begun at once. This will increase the service capacity from 1800 subscribers to about 2400. Underground cables for a portion of Philadelphia street, with later additions, are among the improvements planned. Wardman, who also is manager of the Downey Home Phone, announces a complete change of equipment for that plant. The Downey exchange service at present has 500 subscribers in Downey, Artesia and Norwalk. Considerable extension of the Whittier phone system has resulted from the large oil development in the local field during the past year, as well as the usual city growth.

WATERWORKS.

BANDON, ORE.—The \$48,500 water bond issue has been sold at a premium of \$750.

POCATELLO, IDAHO.—The \$400,000 water bond issue carried at the recent election.

SALEM, ORE.—An independent water system for the State Fair Grounds has been decided upon by the board of directors.

LA GRANDE, ORE.—The city commission has requested City Engineer Neal, Water Superintendent Hoyt and Commissioner Gardner to compile the necessary data and estimate the cost of improvements at the intake to avoid further water shortage.

LOS ANGELES, CAL.—An ordinance has been adopted by the county board of supervisors granting to Benjamin L. Harding a franchise for 40 years, to maintain a system of water pipes in certain portions of Los Angeles county, beginning at the center of Pine and Evergreen avenues.

SALT LAKE, Utah.—The Beaver waterworks system has been sold by Harry S. Joseph to the city of Beaver for \$40,000. Mr. Joseph announced that he had made arrangements with the city of Kamas for franchises for the construction of a water system for that city. Work on the Kamas system will be begun this fall.

LAKEPORT, CAL.—The plan to form a water district in Lake county as a means of opposing the Yolo Water & Power Company's operations was stopped by the serving of a writ of injunction restraining the supervisors from calling an election or interfering in any way with the plans of the Yolo company. The control of the waters of Clear Lake has been a subject of contention for several years between different water companies and Lake county. It is claimed that the construction work of the Yolo Water & Power Company will submerge much valuable land, and to prevent this the organization of a water district was urged. Under the water district law the county would have the powers of a corporation.

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BY CHAMP S. VANCE.

NET EFFICIENCY.

BY BENJAMIN F. PEARSON.

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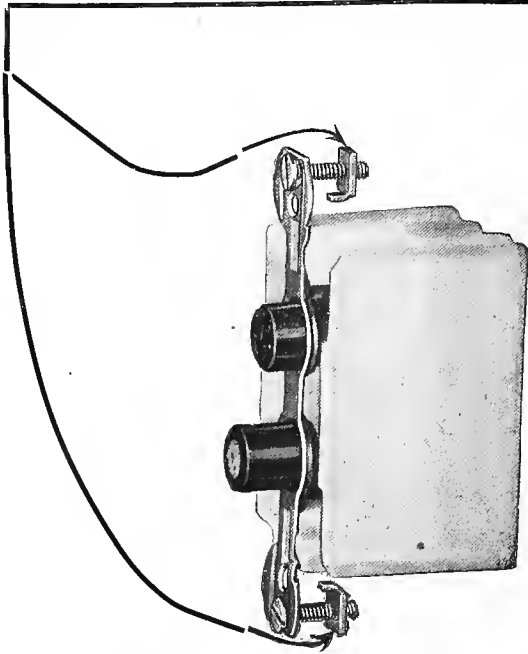
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VOLUME XXXIII

SAN FRANCISCO, SEPTEMBER 19, 1914

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PROGRESS IN THE GAS INDUSTRY

BY CHAMP. S. VANCE.

(This paper constitutes the presidential address of Champ S. Vance at the annual convention of the Pacific Coast Gas Association at Long Beach, Cal., September 15-18, 1914. Especial attention is devoted to legislation affecting utility companies, such as workman's compensation and to recent progress on the Pacific Coast.—The Editor.)

I welcome you to the 22d annual convention of the Pacific Coast Gas Association. My first duty is to thank you for the confidence you reposed in me last year in making me your president. I have tried to the best of my ability to prove myself worthy of the honor bestowed upon me, and I hope I have succeeded in discharging my duties to the satisfaction of all. If I have failed it is not because of lack of loyalty and support on the part of the members of this association.

We assemble here to review the events of the past year in the gas industry and in our association; to benefit each other, our companies and the consumers by imparting any information we may have on subjects of mutual interest. When a group of men meet to discuss the progress of the particular business in which they are interested, each individual is bound to benefit thereby, and I sincerely hope that each member of the association present at this convention will take away with him some practical knowledge that will be of value to him and to the company which he represents. To this end I urge that we all take an active part in the proceedings

which have been provided for this meeting.

The past year seems to have been one of many in bringing out unusual developments in our chosen industry. A number of us have had to contend with rate settlements; compensation laws more than held interest; and the advent of natural gas in some parts of California caused and is causing considerable thought and study. Generally speaking, the year ending will go down in history as one replete with sensations.

Judging from the practice of some of the larger companies, there seems to be a commendable activity toward the complete establishment of a standard gas oil best suited for the purpose. It is gradually being conceded that an out and out crude oil often times leaves much to be desired, and the topping of crude oil is slowly but surely coming into favor. Blending of gas and fuel oils is also being resorted to. It has been shown that this practice is one of merit, and in many cases the result is an excellent grade of gas

oil, amply capable of producing a product well within individual city regulations. Right here it may not be amiss to add that this is a matter which, no doubt,



CHAMP S. VANCE.

could profitably be studied, one well worth the reward, and I hope to hear from a number of you and of your success along these lines at our next meeting.

The manufacture of the carbon by-product into a finished commercial fuel seems to be coming into favor generally. Its excellent quality is being recognized by the consumer to such an extent that it is within reason to predict that "Old King Coal" in California, at least, will soon be routed. There is an inclination on the part of the manufacturers to dispose of this fuel, partially at least, through local tradesmen, thus insuring an even distribution during the heavy winter demands. Further it is an excellent advertising medium, and aids in the solution of the storage problem, where storage space is at a premium.

A large number of new gas appliances, of greater or less merit, seem to have become very prominent. It certainly behooves the appliance men, as well as the gas men generally, to make an investigation of all of these and concentrate efforts upon such as they are assured will best serve the consumer.

Since our last meeting there has been placed upon the statute books of California a new law, far reaching in its consequences, and of especial interest to the gas companies and other public utilities of California. I refer to the so-called Workmen's Compensation, Insurance and Safety Act. This act, in its nature altruistic and designed for the better protection of the workman, establishes a principle of compulsory compensation for industrial accidents; takes from the employer coming within its provisions, the question of the compensation to be made in cases of personal injury to or the death of an employe in the course of his employment, and places such matters in the hands of a board created thereby, and known as the "Industrial Accident Commission." Upon schedules prescribed by the act, the extent of the injury as regards the disability of the injured employe or his death, is correlated with his earning power, expressed in terms of average earnings, and certain fixed sums are prescribed, adaptable to each individual case, to be paid to the injured employe or to his dependents, in installments or as a lump sum. The act further creates a state compensation insurance fund to be administered by the said accident commission for the purpose of insuring employers at their option against liability for compensation thereunder, and provides for the making and enforcement, by such commission, of safety rules and regulations applicable to employers.

The act is not without its faults, and serious ones, which should be remedied. It bears more heavily upon the small employer and the poor man than upon the larger corporations and the man of wealth. For instance, Section 30 thereof places upon the principal the liability for injury to the employe of the independent contractor. This might result in saddling upon a poor man who desired to build a cottage at a cost of not exceeding two thousand dollars, perhaps, the entire liability for the permanent disability of an employe of the carpenter who had contracted to build such cottage. This would inevitably have the effect of driving the poor contracting carpenter or the small contractor out of business in favor of the larger and wealthier corporations or contractors.

The act has the effect of abolishing one class of damage cases and jury trials, except in cases where the injury or death is caused by the personal gross negligence of the employer, an elective officer in the case of a corporation, and will result in the prescription and adoption of certain safety standards and devices. Practically, it will resolve itself chiefly into the matter of a slight increase of operating expenses for insurance, and a greater vigilance in the observance of the safety first doctrine. Many large corporations will, of course, be their own insurers.

While the increase in membership in the association during the past few years has been very gratifying, we must not rest content with what has been accomplished in this connection. When we consider the great number of gas companies operating on the Pacific Coast and note the small proportion of these represented in our organization, we are confronted with the urgent need for missionary work. If the gas companies, not now represented in our organization, could be made realize the benefits to be derived from membership therein, I am sure that they would have no hesitancy about joining. It cannot be claimed that the expense connected with the membership prevents their enrolling with us, for the dues are insignificant and the annual cost of sending representatives to the convention is small. Men attending these conventions cannot fail to increase their knowledge of the progress in the manufacture and distribution of gas, by the interchange of thought on these subjects. The advantages to be gained by affiliation with an association such as ours are so apparent that a review of them would be superfluous.

In 1905 our Association first began to take an active interest in the question of the establishment of a course in gas engineering in one of the Pacific Coast universities, and at our convention that year a committee was appointed to take charge of this work and to consult with the heads of the universities regarding the establishment of such a course. The efforts of the committee did not bear fruit until last year, when a course leading to a degree in gas engineering was instituted in the University of California. Mr. J. A. Britton will tell us about the results being obtained at the University, and will report on what his committee has done since our last convention.

Just a few words regarding the International Gas Congress. The year 1915 should mark an epoch in the history of our association. We have agreed to act as host to what is hoped will be the greatest gathering of gas men ever held in this or any other country. Efforts have been made to have as many gas associations as possible hold their meetings in San Francisco during the week of the Gas Congress, and we hope that they will all find it expedient to do so. Many of the foreign associations have also signified their intention of sending representatives to attend this meeting. We have assumed a big contract, and to successfully perform it, we must have the aid and co-operation of all our members. I am sure that the committee in charge of this matter will appreciate any suggestions or assistance offered by the individual members. Mr. J. A. Britton, chairman of this com-

mittee, has prepared an interesting report on the progress made by his committee since the last convention, and I ask that you give his paper your earnest attention.

At our last convention we adopted a rule that all parts to be presented at our meetings be in the Secretary's hands on a date named by him, and that they be printed and copies distributed to the members in advance of the meetings. The carrying out of this plan should be a source of great satisfaction and benefit to all of us, as it gives each member an opportunity to study these papers and prepare for their discussion. I hope that the gentlemen who prepared papers for this convention have assisted the secretary by complying with this rule.

Each year there is an increase in the number of members who wish to take an active part in the discussions which follow the presentation of papers, but recent years, though the number of papers has been held to a minimum, owing to lack of time, some of these gentlemen have not had the privilege of being heard. Also, it is only fair to the authors that their contributions, on which they have spent much time and labor, receive careful and thorough consideration, but we have found that this is almost impossible in a three days' session. Therefore, we have arranged to have the convention, this year, extend over a period of four days, and we hope that, in this way, everyone who cares to will be afforded an opportunity to give us the benefit of his opinion and experience on the problems presented.

Two of our members were claimed by death since the last meeting, Mr. Geo. S. Colquhoun of San Francisco, and Mr. E. F. Murphy of Modesto, Cal. Mr. Colquhoun joined the association at its sixth convention, and was president during the year 1909-10. Mr. Murphy joined the association at its eighteenth convention. Both were respected by all with whom they came in contact, and we will miss them at our annual meetings. Suitable resolutions will be drafted by our memorial committee and placed upon the records of the association.

In conclusion I extend thanks to all those who have contributed their time and efforts toward making this meeting a success. The work of Mr. Henry E. Bostwick, as secretary, is especially commendable. He has devoted many hours of labor to the affairs of the association, and we should show our appreciation of the work done by him and his associates by making this convention the most memorable and profitable in the history of the association.

Our twenty-second annual meeting is now in your hands. I thank you for your courteous attention.

Motor delivery vans of one of London's largest tobacco firms have been equipped with wireless apparatus in order that help may be rushed to needy smokers on the receipt of the signal S. O. S.—meaning, "Send On Smokes." This firm claims to be the only one in the world using the wireless in its delivery system. The firm communicates through a station on the roof of the building. Aerials are placed on the vans, manipulated by an operator inside.

ELECTRIC FLAT IRON CAMPAIGN.

BY H. S. WELLS.

(In this paper Mr. Wells, who is now business manager for the Pacific Power & Light Company at Portland, Oregon, tells of a successful campaign whereby 650 electric irons were put into so-called saturated lines. Its suggestions may well be followed by other companies.—The Editor.)

The electric iron has so far outstripped other electric appliances in general public use that today the household not equipped with an iron is the exception rather than the rule, and a central station finds the percentage of iron saturation very high among its customers.

To inaugurate a flat iron campaign, therefore, means reaching a comparatively few widely scattered prospects, and to be successful this must be accomplished at a low cost, as the earnings from an iron, either through energy consumed or profit on sales, are too small to justify much expense. Consequently, the ideal solution is to get the prospects to come for the iron rather than to go to the prospects.

This was successfully accomplished by the Pacific Power & Light Company in a flat iron campaign over its properties last spring. The much-used bargain offer proved again its worth, for in spite of the high per cent of saturation on irons, the company sales for the campaign exceeded those of any previous spring campaign, and this effected at a minimum cost. The bargain advertised was "An Ironing Board Given Away With Every Flat Iron Purchased at the Regular Price of \$3.50."

The ironing board was of the latest and most up-to-date folding type, manufactured in Portland by the Oregon Woodenware Company, and is being handled by many of the leading mercantile stores in this section of the country at a price varying between \$2.50 and \$3.00. The bargain was obvious to the feminine mind and was sufficient in itself to draw a multitude of inquiries, and resulted in a large number of purchases. In order to keep the name of the company in the mind of the user, a stamp reading "Electric Ironing Board—Pacific Power & Light Company," was placed in a conspicuous place on each board.

Newspaper and window display, together with descriptive dodgers sent out in the monthly bills, were the mediums of conveying the offer to the public, and represented the only expense of the sale.

Before the campaign started it was estimated that there were 1800 lighting customers not using irons. Of this number, 20 per cent were eliminated as non-prospects, leaving 1456 prospects. The campaign resulted in "landing 40 per cent of these prospects, thus putting some 650 irons on the company's lines. All expenses of the campaign were paid from the profits on the merchandise. In large quantity shipments the ironing boards were laid down f.o.b. properties for approximately \$1 each, and as the combination iron and ironing board sold at \$3.50 there was a fair margin of profit.

Germany's two greatest electric manufacturing companies are the Allgemeine Gesellschaft and the Siemens and Halske Company, which together have a capitalization of nearly \$52,000,000, and last year did a business of about \$170,500,000.

NET EFFICIENCY.

BY BENJ. F. PEARSON

(In epigramatic and forceful language the author explains the meaning of net efficiency and illustrates its application in the conduct of an electric power company. Mr. Pearson is general superintendent of the Southern California Edison Company of Los Angeles.—The Editor.)

In the space at my disposal it will be impossible to even touch on many phases of the question that suggest themselves as being necessary in a discussion of the subject, efficiency, particularly "net efficiency."

Efficiency is the keynote of progress; the secret of success; is the exclamation point between profit and loss; it spells maximum service, courtesy, patience, co-operation, and untiring efforts; it rings down the curtain on laziness and indifference, and goes on with the task after the clock points to the hour of quitting time; it knows no limitations of effort; no departmental boundaries. Its watchword is vigilance and its tocsin, endeavor.

Efficiency is never satisfied. Its ultimate goal is never reached. It is always striving to do the task better, to accomplish more within a given time; more, with the material and equipment in hand. It never measures out a certain quantity of work for a given compensation; it is the additional mile per gallon of gasoline; the extra kilowatt per barrel of oil; the vital attention to every detail of operation which will reduce cost to a minimum, and give the greatest measure of service for every dollar expended. It involves the principle on which every real success is founded. It is the only substitute for municipal ownership, and the court of last resort between utility corporations and regulating commissions.

In mechanics, efficiency is the ratio of useful effect to the expenditure of energy. It is just as true of every department which makes up the organization of a public utility corporation, as the ratio of useful effect to the expenditure of energy, in any department, whether it be manufacturing, construction, transmission, distribution or sales, contributes to the profit or loss of the product marketed.

I have been asked to refer briefly to the efficiency of a tungsten filament lamp on a consumer's premises, compared with the fuel oil used to generate steam for power purposes. The average layman does not comprehend the enormous losses involved between the boiler furnace and the light, and without going into tiresome detail, it will be sufficient to state that of the initial energy contained in a barrel of oil, approximately only one-quarter of one per cent reaches the consumer in light—"candle power." By the various processes of combustion, radiation of heat, generation, transmission, transformation and distribution, 99.75 per cent of the initial energy in the fuel oil is lost.

The following table, for the sake of illustration, segregates the principal items, showing the approximate efficiency of the different elements of production and distribution under average normal operating conditions: Energy from fuel oil to tungsten lamp light:

	Per cent Efficiency.	Energy.
Fuel oil	100	100
Boiler and economizer	85	85
Turbine	19.8	16.8
Generator	96	16.1
Step-up transformers	98.5	15.9
Transmission line	90	14.3
Step-down transformers	98.5	14.1
Distribution	90	12.7
Tungsten lamp	2	0.25

For the sake of comparison, and to more clearly bring out the relation between the raw material and light, we might compare the system to a mint, the results obtained are the same as though we gave to the mint in raw material one dollar, and after passing it through the processes of coinage, only one-quarter of one cent was obtained; or, for every \$4.00 in raw silver one cent; for \$1000 only \$2.50.

To bridge this gap the greatest minds of the engineering world have devoted their energies. Laboratories involving millions of dollars, and the unstinted devotion of thousands of men are engaged, and every new development, involving the slightest improvement in efficiency is considered a tremendous advance in the art.

We are all familiar with the old trite saying, that "the individual who makes two blades of grass grow where only one grew before, is a benefactor to the human race," but in this present day when fuel and light are of prime importance to the welfare of the entire world, the "individual who can make" two kilowatts "grow" where only one grew before, is of even greater importance and in a much larger sense a benefactor; and while scientists and engineers are engaged in the struggle with inefficiency, the operating forces are often negligent of the tremendous possibilities in their power, enabling the company to sell the finished product to the consumer at the state of highest efficiency. A recent case brought to my attention serves to illustrate one point:

A certain factory which had been engaged in one line of business for twenty-five years, changed management. The new manager immediately posted a bulletin inviting all employes to make recommendations which might involve a reduction in the cost of manufacture, offering as an incentive a bonus and increased salary for all accepted ideas. "Dobbs" was foreman in room No. 4; Dobbs, thought, and finally hit upon an idea which would reduce his operating force 50 per cent; with a great deal of elation he informed his wife of his discovery; then came the query, "What will happen to Smith, whose wife is paralyzed, and Jones, who is buying a house on the installment plan, and Brown, who walks lame as the result of a broken hip"; Dobbs procrastinated and postponed making the recommendation from time to time. Two months later the new manager called Dobbs in and informed him that his services would not be required after the end of the following week; that one of the men in Dobbs' room had made a recommendation which would reduce the working forces 50 per cent, and had been appointed foreman in Dobbs' place.

While it was commendable in Dobbs to be concerned for the welfare of the other fellow, his first consideration under the circumstances was his employer's interests, which involved, as was seen, his own welfare; and better than this, the reduction in operating expense made it possible for the factory to increase its output, marketing the product at a lower price and the men in room No. 4 were reinstated after a short vacation, in other lines of employment.

Net efficiency spells the existence of the company; the existence of the company directly affects the welfare of every employe, officer and stockholder. Net efficiency operates directly on the pay roll, and each

employe in the company's service is contributing, not simply to his own welfare, but to the existence of the company, and to the general welfare of the community at large. Every minute during working hours, of each employe, is contributing for or against the desired and absolutely necessary result, namely, the marketing of the company's product at a price which shall pay all the necessary expenses, and return interest on the investment. The relation between the dollar invested by the stockholders and the cost of the physical property on which is based the price of the commodity, is one of the greatest tests of efficiency. If one pole in a given line, due to laziness or lack of attention or wrong methods, costs \$5 more than any other pole in that line, then that particular pole is burdened to the extent of earning not less than 50 cents per annum more than its fellows; and it is a direct charge, absolutely unavoidable, against every kilowatt carried over the line.

Every man engaged in construction or the installation of new apparatus is contributing directly to the net efficiency and is fixing a charge upon the books which can never be altered by any economies in operation. The man who is vigilant and constantly observing the rules of the game will study to see how every given process in the work may be reduced as to time and in the use of material. Every dollar saved is 10 cents gained. The responsibility begins with the construction men and ends with the operating department. The fireman regulating the volume of air taken into a furnace has a direct relation to the net efficiency of the company; and every employe in every boiler room and engine room should be constantly on the alert to operate at the highest point of efficiency, and on the other hand, the greatest economy, stopping leaks, not only in leaky joints, but remembering that every drop of condensate water represents a given amount of fuel oil; every drop of machine oil wasted is contributing to the operating expense and reducing profits, and making more difficult the problem of rate adjustment between the corporation and municipal governing bodies.

Every man who by careless methods destroys material, whether it be a piece of copper wire, a bolt, a cross-arm, or any other element entering into the construction of the company's property anywhere, is contributing to increasing fixed charges and the operating expenses.

"Oh, that's good enough," is a remark only too commonly made by the average individual working for a living; and it will be found in every instance that where this is the motto back of a man's relations to his employers, that particular individual will never succeed. Neglect, indifference, "don't care," are all friends of inefficiency and failure, and all help to retard the machine as a whole. Promptness in beginning work and leaving only when the task is done (should it be necessary to finish it today), and the response "Aye, aye, sir," to every demand, no matter whether it involves the particular work of the individual, or the digging of postholes by an accountant, the operation of a substation by a department head,—"We worked fifty hours straight, but we got 'er on the line,"—is the spirit that spells efficiency.

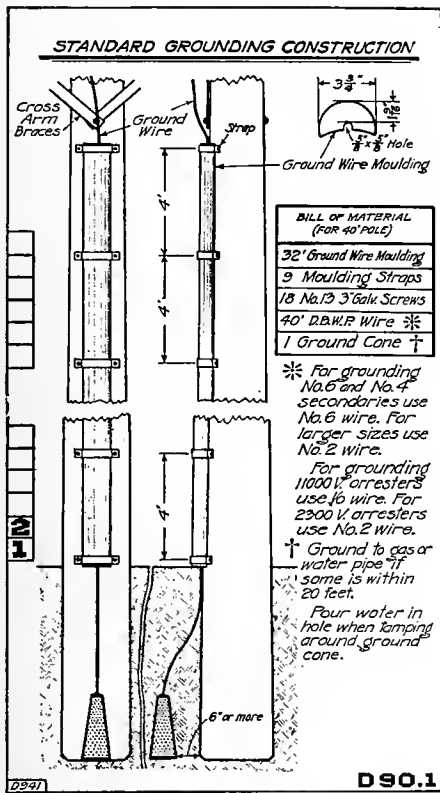
It will be also found that co-operation as between various departments—the employes in the departments—is absolutely essential to the best results. We point with a great deal of pride to our "Edison Spirit," which involves many of the elements which have been referred to as being contributory to the highest state of efficiency. The man who sees a task to be performed, but who because it is not in his department, answers, "Let Bill do it," or "That's none of my business," is not a loyal employe in any sense of the word.

The spirit of co-operation has been well exemplified during the past month or two, when strenuous methods have been adopted looking to the reduction in operating expense to meet the unsettled conditions. In some instances, in reducing our forces, it has been necessary to suggest to sub-foremen in the electric distributing department that they could contribute to the desired result by putting on a pair of spurs and "climbing with the rest of the gang." In no instance has this request met with a refusal, but in every case there has been instant approval of the measure, and men who have not worn spurs for a number of years are today "climbing" to the top of the pole, actually and figuratively, in response to the request of our general manager, that every economy of every character should immediately be put into effect. This is the spirit that wins the game, and the Southern California Edison Company is justly proud of an organization that responds to every exigency, and the general superintendent is able to say, that at no time, during the period of his office, has he ever made a request or a demand which has not been met with instant and hearty obedience, so let us continue to pull "altogether, with a long pull and a strong pull," and the net efficiency obtained as the result will be gratifying to all concerned.

History teems with examples in every walk in life; men who have risen by dint of their own effort and who lead the professions. In every instance it will be found that each man kept constantly in view the thought, how to better perform a given deed, using less time and less material. A man will find conditions crowded at the bottom of the ladder; the higher up, the more room, and it should be the aim of every employe of the Southern California Edison Company to contribute to its existence by putting forth every endeavor that shall result in a greater net efficiency, making successful competition impossible and municipal ownership unnecessary.

Hand fired boilers of the return tubular type can be fired without violating the smoke ordinances of most American cities with proper boiler-room supervision. According to the investigations of the U. S. Bureau of Mines the prevention of smoke may be more easily accomplished when the coking method of firing is employed than when the alternate-spreading method is used. The use of supplementary air immediately after firing tends to increase the over-all efficiency and in the production of more smoke. The screening of heating surface in the combustion chamber from direct radiation from the brickwork tends to lower the combined efficiency.

Standard Grounding. Sheet D 90.1 illustrates the standard method of grounding transformers, lightning arresters or metallic pins at railroad crossings. Clear redwood is used for molding, there being 1½ inches of wood around the conductor at all points, to comply with Statute 499.



Lighting Services: The following schedule of overhead services is inserted for linemen and meter setters:

Two Wire Services.	
Number of Circuits.	Size of Wire.
1 or 2	10
3 or 4	10
5	8
6 or 7	6
8 or 9	4
10 to 14	2

Three Wire Services.	
Number of Circuits.	Size of Wire.
8	10
9 or 10	8
11 to 15	6
16 to 19	4
20 to 29	2
30 to 42	1/0
43 to 50	2/0
51 to 72	4/0

No. 10 wire is used only where the length of service is under 100 ft.; where the length exceeds 100 ft., No. 8 wire is used.

The local electrical ordinance requires that buildings be wired three wire where the number of services used exclusively for lighting exceeds seven.

State Law: The final sheets of Section D contain extracts from the state law on line construction. Only such items as apply directly to the construction of the San Diego company are included and these are much condensed. Because of their accessibility in other form and of their local application they are omitted in this series.

[To be continued.]

REPORT ON INDUCTIVE INTERFERENCE.

(A report of the results and recommendations to the Railroad Commission of California by a joint committee authorized by the Commission to investigate remedies for the inductive interference of power lines with telephone communication. The findings were presented as a paper at the Spokane A. I. E. E. meeting on September 11, and the recommendations form the basis of an order from the Commission.—The Editor.)

Future Work.

The further work necessary in order to secure the information essential as a basis of determining more explicit and effective rules than those herein recommended, is particularly concerned with the subjects of transpositions and residual voltages and currents. In order to cover these subjects in as effective and economical a manner as possible it is thought that the procedure should be along the following lines:

1. Experimental study of transpositions, which includes the determination of:

- a—the practical effectiveness of transpositions in both power and communication circuits as a means of reducing induction arising from balanced voltages and currents; involving considerations of different co-ordinated transposition schemes particularly with different lengths of power circuit “barrels.”
- b—the practical effectiveness of transpositions in communication circuits as a means of reducing inductive interference arising from residual voltages and currents; involving considerations of different systems, particularly different lengths of balanced communication circuit transposition sections.
- c—the influence of imperfect electrical balance of communication circuits in impairing the effectiveness of transpositions.
- d—the practical effectiveness of transpositions in a power circuit isolated from ground as a means of balancing the electrostatic capacities to earth of the several conductors, and thereby reducing residual voltages and currents; involving considerations of the relative efficiency of different lengths of power circuit barrels.

2. Experimental study of the causes and effects of residuals, including:

- a—a comparison of the different types of power system connection and apparatus in common use and their characteristics in respect to the production of residuals, particularly harmonic residuals.
- b—means to be employed in limiting residual voltages and currents.
- c—a determination of the minimum values of residual voltages and currents which will produce harmful inductive interference.

It is thought that these two studies could progress simultaneously. The work indicated under (1) could best be done on an actual parallel selected to be as uniform and as free from secondary disturbances as possible. Some preliminary work has been done along these lines which indicates the best methods of procedure and this should facilitate the carrying out of the investigation.

The study mentioned under (2) consists in part of an investigation of the characteristics and magnitude of residual voltages and currents in typical power systems, both those with grounded neutrals and systems entirely isolated from ground. A part of the study of residuals is logically related to the study of transpositions and could be carried out in connection with the study outlined under (1) and at the same time and place.

In addition to the above the committee has already arranged for the investigation of the two following subjects:

- 1—a determination of the detrimental effect of extraneous currents on a telephone circuit as a function of the frequency, including a determination of the maximum amount of extraneous current, of different frequencies and combinations of frequencies, which is allowable in a commercial telephone circuit.

2—a determination of the effects of extraneous current of different amounts and characteristics in limiting the speed of telegraph operation.

This work is now in progress.

Appendix I. Harmonics.

Any complex electrical wave of periodic structure may be resolved into component sine waves of suitable amplitudes and phase differences, having frequencies which are in integral relation to the fundamental frequency. The simple sine wave of lowest frequency is termed the fundamental, and those of higher frequency are termed harmonics of the fundamental wave. The fundamental may be considered the first harmonic. The analysis of a periodic wave into its constituent sine waves or harmonics is not merely a mathematical conception or process but is in accordance with the facts of electricity and acoustics.

In general, alternating current systems, by virtue of their inherent characteristics, do not permit the existence of harmonics other than odd integral multiples of the fundamental frequency, i. e., 3d, 5th, 7th, 9th, 11th, etc., harmonics. Such harmonics may exist in either or both the current and voltage waves of a power system.

Commercial frequencies of power transmission in California are 25, 50 and 60 cycles per second. The power systems, so far investigated, operate at a fundamental frequency of 60 cycles per second. The investigation has shown harmonic currents and voltages of appreciable magnitude up to the 35th harmonic. On one system the 23d (corresponding to a frequency of 1380 cycles per second) has been found to be prominent. Induced currents and voltages in parallel communication circuits have been observed corresponding to these harmonics.

The detrimental effect of the induced voltages and currents in parallel communication circuits depends, in general, upon their magnitude and upon the frequency of the induction as compared with the operating frequency of the communication circuit. The presence of extraneous current of a frequency approaching that of normal operating frequency of the communication circuit has a more injurious effect than the same amount of current of a frequency far removed from the operating frequency of the circuit.

The frequency of the voice currents flowing in a telephone circuit ranges from about 200 cycles per second up to possibly 2000 cycles per second. The average voice frequency is considered to be approximately 800 cycles per second, and at about this frequency the telephone receiver is most sensitive. It is on account of these considerations that extraneous currents of the higher frequencies, arising from the harmonics of a power system, are relatively more detrimental to telephone service. The harmonics of the power systems have been found to be responsible for the greater portion of the inductive interference to telephone service, under normal operating conditions of parallel power circuits. Any extraneous current of a frequency within the audible range produces a disturbance which impairs the efficiency of a telephone circuit. The combined effects of all extraneous currents present, of frequencies within the range of audition, constitute the humming "noise" heard in the receiver of a telephone circuit which is subject to induction.

The effect of currents of the fundamental frequency (60 cycles or less) on telephone circuits is relatively unimportant as compared to that of higher harmonics owing to the fact that the fundamental approaches the lower limit of audible frequencies. However, if the induction due to the fundamental becomes sufficiently great, constituting a physical hazard, or of such magnitude as to operate the protective devices on the telephone circuits or interfere with superim-

posed telegraph service or other grounded signaling devices, it is then of great importance from the standpoint of interference.

In regard to the effect of extraneous currents on the operation of telegraph circuits, for reasons analogous to those given above, such circuits are relatively more affected by extraneous currents of fundamental frequency or of the frequencies corresponding to the lower harmonics such as the 3d and 5th.

At the present time the American Telephone & Telegraph Company is undertaking, on behalf of the Joint Committee on Inductive Interference, an extensive series of tests in regard to the detrimental effect of extraneous currents of various frequencies on the intelligibility of telephone conversation. In addition, this company, in conjunction with the Western Union Telegraph Company and the Postal Telegraph Cable Company, is undertaking an investigation of the effect of extraneous currents on the operation of telegraph circuits and apparatus of different types.

Harmonic currents and voltages in power circuits arise from many causes. Generators or other rotating machines do not, in general, produce pure sine waves of fundamental frequency. This is due to several features in the design of the apparatus. A certain amount of distortion of wave form, with the consequent introduction of disturbing harmonics, is inherent with the use of transformers. This distortion of wave form is due to hysteretic action in the iron core of the transformer. The distortion varies in character and magnitude with the saturation and characteristics of the iron employed. Certain connections of transformers are possible which will suppress the third harmonic and its multiple in a three-phase power system. The fact that practically all inductive interference to telephone circuits is due to the harmonic currents and voltages, renders it important that an effort be made to obtain rotating machinery for use in power systems which produces as nearly as is reasonably possible pure sine waves of fundamental frequency, and also that an effort be made to obtain transformers and to arrange connections of the same in such a manner as to reduce as far as practicable the distortion of wave form.

Electric lamps for oil well use is the subject of a technical paper from the U. S. Bureau of Mines which recognizes the greater safety of incandescent lamps over any form of open flame for lighting gaseous places. Certain precautions are needed to prevent bulbs breaking and allow glowing filaments to ignite explosive gases. Tests show tungsten filament lamps are more dangerous than carbon filament, the conclusion being that the best incandescent lamp to use for lighting gaseous places is the 8 candlepower, 220 volt, carbon filament lamp, and that the safety of this lamp can be largely increased by using bulbs that are constructed without a tip. The electric wiring used in connection with the lighting of gaseous places should, within the limits of the region made dangerous by the presence of gas, be carried in iron-pipe conduit, and the fittings, such as switches, sockets, and junction boxes, should be made to correspond. If it is necessary to install the switches where gas is liable to be present, the switch boxes should be made gas tight. Additional safeguards around lamp bulbs, such as heavy glass outer globes and metallic guards outside the outer globes, provide a factor of safety that is highly desirable.

A KEY TO THE INDEX OF ELECTRICAL DEFICIENCIES, AS URGED BY THE UNDERWRITERS' EQUITABLE RATING BUREAU, PORTLAND, ORE.

BY F. D. WEBER.

[Concluded.]

Wire:

490—Wires of opposite polarity in contact (a) or too close together.

See Code Rule; Inside work 20 (d), 26 (h), (j), (r), 44 (c); Outside work 12 (b), 13 (c), (d).

491—Service discontinued, but live wires still attached to building.

Should be removed.

492—Wires not bushed at entrance.

See Code Rule 12 (f), 85 (e).

49v—Wires against or too close to grounded pipes, or improperly protected.

See Code Rule 16 (e).

494—Wires not protected where liable to mechanical injury.

See Code Rule 20 (e), 26 (c).

495—Wires in contact with outside awning (a) or with metal front or side of building, (b) with metal ceiling.

Iron conduit must be used to protect wires where same come in contact with awnings, metal fronts or side of buildings. See Code Rule 12 (d).

496—Telephone or signal wires in contact with (a) or too close to light or power wires.

See Code Rule 16 (e).

497—Wires not bushed (a) or bushed improperly through walls, floor or partitions.

See Code Rule 16 (d).

498—Wires of opposite polarity through one hole.

Wires must be spaced according to Deficiency 490.

499—Wires too small current carried.

See Code Rule 18.

500—Wires not attached rigidly in position (a) or loose from support.

Wires must be held rigidly by all fittings; See Code Rule 26 (g).

495 (b)—With metal ceiling.

Must be insulated from the metal ceiling by porcelain knobs, cleats or wooden moulding on wooden backing or placed inside of rigid or flexible iron conduit or metal moulding.

501—Other than rubber covered wire used for concealed work.

See Code Rule 26 (n), 26 (q).

502—Wires not properly separated on concealed work.

See Deficiency 490.

503—Wires not supported at sufficiently frequent intervals.

See Code Rule; For open work 26 (h), i, j; For concealed "knob and tube work" see Code Rule; 26r High Potential Systems, Code; Rule 44 (c); Outside work, Code Rule 12 (d).

504—Solid wires used at conductors to swinging or movable lamps.

Series arc lamps; See Code Rule 21 (e); In damp places see Code Rule 21 (b). If stranded wires are used, they will be broken off if they are bent frequently.

505—Wires not entering conduit properly at change from knob and tube to conduit work.

See Code Rule 59 (i), 28 (d), (e), 27 (e), 26 (t); See Fittings under heading "Conduit Boxes," "Conduit" outlet bushings, couplings and fittings.

506—No fuse used where change is made in size of wire.

See Code Rule 23 (b).

507—Service wires in bad shape or not properly attached to or insulated from building.

See Code Rule 12.

508—Wires in contact with other materials than insulators.

Wires must be supported on porcelain knobs or cleats or placed inside of wooden or metal moulding approved iron conduit, approved flexible tubing, or approved metal armored cable.

509—Unapproved wire.

See Code Rules.

Wire:

Aluminum	18 (a)
Armored (See Armored Cable)	
Concentric	56 (c)
Conduit	56
Construction of, general rules	49
Fixture	55
Flexible cord (See Flexible Cord)	
Lead covered	50 (j)
Netting on Arc Lamps	21 (c), 33 (c)

Rubber-covered	50
Slow burning	52
Slow-burning, use of in dry places	26 (g)
Slow-burning, weatherproof	51
Weatherproof	53

See Fittings under heading "Wire."

511—Overfused wire.

See Code Rules 8 (b), 18, 23 (d) and (e); See Motor Data Book for Motors.

512—Wires not properly supported over roofs.

See Code Rule 12 (c).

513—Wires in open work not properly spaced.

See Code Rule 26 (g), to (p).

514—Wires held in place by the wires on sizes smaller than No. 8 B. & S. gage.

See Code Rule 16 (b).

515—Bare wire.

See Code Rules 26 (g), (i), (k), (n), (q), (v); 49 to 57 incl.; See Fittings under heading "Wires." The only place where the N. E. C. sanctions bare wire is for "Trolley" service.

516—Wires knobbed (a) or cleated over horizontal surfaces.

It is impossible to maintain open "knob and tube" wiring over flat horizontal surfaces therefore, this Bureau requires moulding conduit or armored cable work.

517—Dead circuits and wires should be removed.

This Bureau requires the removal of all dead circuits and wires which are in a non-standard condition when a building is rewired as irresponsible parties may connect same to the approved portion of system. Also the dead circuits and wires are many times interwoven with the standard portion making the whole system non-standard, and hazardous.

518—Cleated (a) or knobbed over grounded surfaces.

This Bureau requires the use of a "backing" of wood to fasten knobs or cleats in position when wiring is installed over grounded surfaces.

519—Wires inside of cabinets should be neatly cabled.

Wires inside of all cabinets must be neatly cabled in order to keep them in place.

520—Wires must enter cabinet through openings made for that purpose only.

The practice of bringing wires into cabinets through all manner of openings, is not sanctioned by the Bureau. See Code Rule 26; See Fittings under heading "Conduit outlet bushings and bushings."

521—Wires should be kept free of dust accumulations in sawmills, feed mills and similar places.

Accumulations of dust, rubbish, etc., should be cleaned off open wiring in order to keep it from becoming in a hazardous condition.

522—Two wires on one single-wire knob or cleat.

It is impossible to get the proper distance between wires when two or more wires are placed on one single-wire cleat or knob; See Deficiency 490 and 513.

523—Wires run without insulating supports such as knobs, cleats or tubes.

See Code Rules 16 (d), 26 (h), (j).

Wireless Telegraph.

600—Not properly installed according to requirements of National Electrical Code.

See Code Rule 86.

524—Duplex rubber covered wire (a) single conductor rubber covered wire (b) weatherproof wire, (c) slow burning wire (d) lamp cord, (e) reinforced cord (f) stage cable (g) border light cable (h) packing house cord (i), fixture wire (j), armored reinforced cord, installed in an unapproved manner; (k) Brewery cord. Each of these different types of wire are manufactured for a special purpose or use and must be used for these specific purposes only—as their construction being designed for specific purposes may introduce a hazardous condition when not properly used.

See Code Rule 26(d); See Code Rule 56. This to be used only in iron conduit systems. (a) See Code Rule 26 (g), (k), (q), must not be used for pendant lights or for connections to portable apparatus; (b) See Code Rule 53. See Code Rule 12 and 26 (i) and (j); (c) See Code Rule 52. See Code Rule 26 (g) and (h); (d) See Code Rule 54. See Code Rule 32, must not be used on insulators, in conduit or through porcelain bushings or in moulding (wood or metal); (e) See Code Rule 54. See Code Rule 32 (d); (f) See Code Rule 54. See Code Rule 38; (g) See Code Rule 54. See Code Rule 38; (h) See Code Rule 54. See Code Rule 31 (b); (i) See Code Rule 55. See Code Rule 26 (v) and (y); (j) See Code Rule 57. See Code Rule 32 (e). See Code Rule 54; (k) See Code Rule 54. See Code Rule 31 (b).

Miscellaneous:

700—Inspector was refused permission to enter risk.

This is self explanatory. This attitude of owners and tenants handicaps the inspection department many times. In aggravated cases causes the Bureau to resort to making a charge in the insurance rate.

A. I. E. E. AND N. W. E. L. & P. A. CONVENTION.

The joint parallel sessions of the annual convention of the Northwest Electric Light & Power Association and the Pacific Coast convention of the American Institute of Electrical Engineers was held at the new Davenport Hotel in Spokane, Wash., September 9, 10, 11, 1914. The meetings of both organizations were well attended and the papers interesting and provoking spirited discussion. Particular credit is due to the Washington Water Power Company for their capable handling of the arrangements and hearty thanks were extended for their bounteous hospitality.

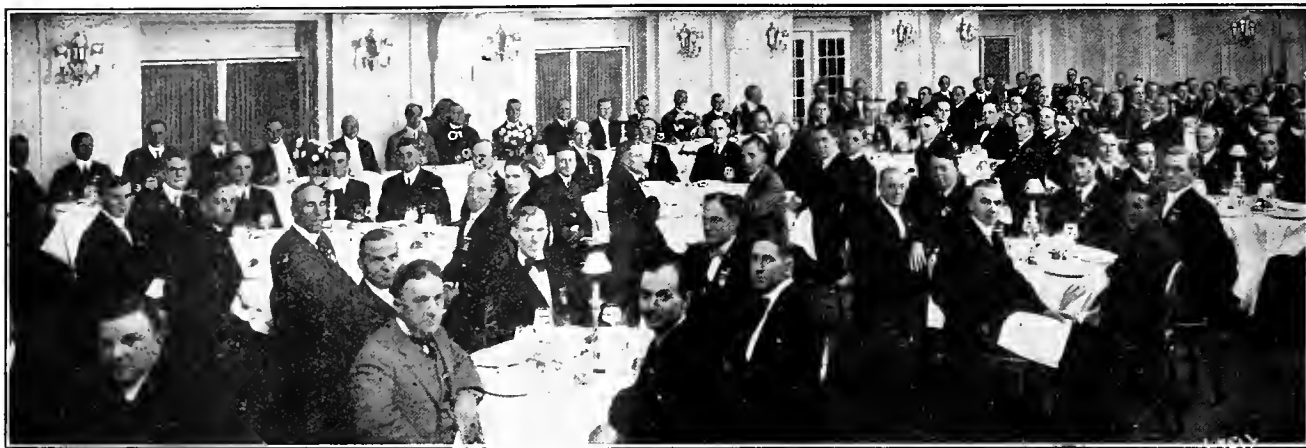
The Institute meeting was honored by the presence of President Paul M. Lincoln and Hon. Sect. Ralph W. Pope. It was decided to hold the next convention at San Francisco, probably as a part of the

words of thanks. The two organizations then went into separate session, as is reported hereafter.

A joint session was again held on Wednesday afternoon, when the Hon. W. W. Cotton gave a clear forecast of the future and the pitfalls that the electric companies should seek to avoid by profiting from the experience of the railroad companies. The subject of his address was "**Rates and Physical Valuation of Public Utilities**," a summary of which appears on the editorial page of this issue.

"**Outdoor Substations**" was read by the author, J. C. Martin. A brief abstract follows:

The outdoor substation has been evolved to meet the demand for a type of construction in serving rural districts which will at once be reliable, efficient and low in cost. These substations have capacities as low as 25 k.v.a. and voltages at least as high as 66,000. The main factors con-



Banquet at Joint Convention.

regular annual convention of the A. I. E. E. Prof. Harris J. Ryan was indorsed as the choice for the next vice-president, with J. B. Fiskien as the alternate.

O. B. Coldwell, general superintendent of the Portland Railway, Light & Power Company, was elected president of the Northwest Electric Light & Power Association for the ensuing year; E. G. Robinson of Arlington, Washington, vice-president for Washington; Attila Norman of Eugene, Oregon, vice-president for Oregon, and Robt. A. Foster of Lewiston, vice-president for Idaho. The executive committee comprises N. W. Brockett of Seattle, president; W. J. Grambs, Seattle, Arthur Gunn, Wenatchee, P. A. Bertrand, Aberdeen, L. B. Faulkner of Olympia and H. L. Bleecker of Spokane. E. A. West, efficiency engineer for the Portland Railway, Light & Power Company, was appointed secretary.

Joint Sessions.

The joint session convened at 10:15 Wednesday morning, with H. L. Bleecker, president of the N. W. Electric Light & Power Association, in the chair. Mr. Bleecker introduced W. J. Hindley, Mayor of Spokane, who welcomed the delegates to the "city of light and power" in well chosen words. His speech was marked by a wide understanding of the efforts of electrical men to supply utility service and was characteristically just in its appreciation of the work that they are accomplishing.

N. W. Brockett, secretary of the Association, responded to Mayor Hindley's address in appropriate

considered are transformers, protective devices (such as fused air-brake switches), control apparatus and supporting structures. A number of examples are given of construction along the lines of the Pacific Power & Light Company.

The discussion was opened by H. V. Grieser, who described the practice of the Washington Water Power Company in the design and operation of outdoor substations. President Lincoln inquired as to the success of the air-brake switch and fuses in high tension operation. J. Harisberger, F. B. Fiskien, O. B. Coldwell, L. T. Merwin, M. H. Gerry and F. D. Nims stated that they were being satisfactorily used on their systems. J. C. Martin closed the discussion by stating that he did not approve the use of secondary or low tension fuses, but would use a low tension circuit breaker. He also reiterated his experience in the satisfactory use of oil which has been shipped in the tanks of high tension transformers.

"**Electric Power Development on the Pacific Coast**," the last paper at the joint conference, was read by W. E. Herring, a summary of which follows:

The increase in water power development on the Pacific Coast has been greater than that in any other section of the United States. New capital is needed to care for new industries. Figures are given of the development in each of the Western States, with detailed account of companies serving the several districts. Before 1910 the operating companies had difficulty in obtaining capacity needed for the demand upon their plants, but since then an over-development, based upon estimates which have not been realized, gave a surplus of at least 40,000 h.p. in the Northwest, the development of an irrigation load alone having prevented a similar

excess in California. On this account the Northwest should prove an attractive field for the establishment of large power-consuming industries desiring electric current at low rates.

O. B. Coldwell opened the discussion by praising the timeliness of this paper. He emphasized the increasing importance of water storage with recent improvement in the load factor of hydroelectric plants. C. S. MacCalla commented on the over-development of water power in the Pacific Northwest. J. C. Ralston emphasized the duty of the engineer in educating legislators with regard to existing conditions. W. E. Herring closed the discussion by reference to the dire need for a wider understanding of the facts before rational legislation can be expected.

Entertainment Features.

All of the many features of the entertainment provided were extended jointly to the members of the two associations. The visiting ladies were the recipients of many courtesies, a series of receptions, teas, theater parties and automobile trips occupying all of the time that the members were attending the meetings. Great credit is due to S. E. Gates, chairman of the entertainment committee, and the other members for the able manner in which every possible detail had been anticipated.

On Wednesday evening a Dutch lunch was held at the Davenport Hotel. On Thursday evening an illustrated lecture on the electrical features of the Panama-Pacific International Exposition was given by A. H. Halloran, who also announced that there was grave doubt as to whether the International Electrical Congress would be held in 1915 because of the European war; and on Friday evening the annual banquet of the two organizations was held.

O. B. Coldwell, newly elected president of the Association, presided as toastmaster at the banquet, which was enlivened by the reading of frequent telegrams. Brief remarks were made by President P. M. Lincoln, R. W. Pope, N. W. Brockett, W. H. Fraser, John B. Fiske and A. H. Halloran.

On Saturday an all-day excursion by automobile was taken to the Little Falls and Long Lake plants of the Washington Water Power Company and the Nine-Mile plant of the Inland System, an enjoyable camp lunch being served at Long Lake. On Sunday a trolley trip was made over a part of the Inland Empire Railway Company's system, lunch being served at Bozanta Tavern, Hayden Lake, and a visit made to the Washington Water Power Company's Post Falls plant.

A Jovian Rejuvenation was held at the Pythian Hall on Saturday night under the direction of Statesman L. F. Austin, who also officiated as Jupiter. The other members of the degree team were:

Neptune	H. K. Stacey	Apollo	J. A. Gorman
Vulcan	H. L. Bargion	Hercules	C. L. Bankson
Mars	M. Sebern	Avrenim	L. N. Rice
Pluto	E. J. Simon	Mercury	H. G. Peirce

Imps: H. J. Billiea, A. S. Hall, J. Perry.

A large measure of the success of the rejuvenation was also due to the energy and enthusiasm of L. A. Shorno. Among the several remarkable features was a wrestling match between a bear and certain unfortunates, a well-staged explosion and a supper cooked entirely by electricity.

A. I. E. E. Session.

"Effect of Delta and Star Connections Upon Transformer Wave Forms" was the subject of a paper by Leslie F. Curtis, read by the author. An abstract follows:

The purpose of the paper is to show the distortions resulting from different symmetrical three-phase connections of generator and transformers without transmission line, as dependent upon the hysteresis cycle and the admittance of the transformers at no-load.

Tests were made with the oscillograph to show the no-load exciting current and voltage waves of three single-phase step-up transformers when the windings of the generator and both sides of the transformers were connected in all possible symmetrical delta and star relations.

Tests are divided into four groups, according to the connection of the generator. In all cases normal low-tension line voltage was held, but voltage and current measurements were considered less important than the recording of wave forms.

Oscillograms are given in each case and the relations between the flux, voltage, exciting current and the hysteresis cycle are shown in two instances.

The author points out that the best voltage wave forms will, in general, be obtained with a star-connected generator and delta-star or star-delta connected transformers.

The discussion was opened by President P. M. Lincoln, who illustrated the effects of the third harmonic by means of the equilateral triangle diagram and neutral points. A. A. Miller commented upon the ease and accuracy with which such subjects are now diagnosed by means of the oscillograph. M. H. Gerry spoke of the value of these results in directing practical work. L. T. Merwin asked for a recommendation as to the best connection for the protection of transmission lines beyond the power house against insulation breakdown. L. P. Ferris illustrated the connections of an air core inductance coil in series with an oscillograph as used by the Committee on Inductive Interference.

"150,000 Volt Transmission" was read by the author, Edward Woodbury. An abstract follows:

The paper describes operating conditions on the 150,000 volt transmission line of the Pacific Light & Power Corporation which delivers power from the Big Creek hydroelectric development to Los Angeles, Cal., 240 miles away. In daily operation 60,000 kw. are generated, utilizing a total hydraulic head of 4000 ft., in two steps. Plans for the future contemplate the building of two more power houses, operating under somewhat lower heads.

Of particular interest is the complete success of the constant potential system, i. e., operation at the same voltage at the generating and receiving stations, by means of synchronous condensers at the receiving end, in conjunction with automatic voltage regulators, one for each condenser as well as for the generators at each of the power houses. The line has been operated with unusual freedom from short circuits.

Appendixes describe the development of the system, and give data relating to the equipment of the Big Creek transmission line.

J. Harisberger opened the discussion by requesting information as to the need for synchronous condensers. J. B. Fiske inquired if it would be possible to cut out the synchronous condensers from 6 a. m. to 8 p. m., and also asked whether a resistance or reactance was used in the ground connection. Mr. Woodbury later replied that synchronous condensers hold

the voltage at the receiving end practically constant regardless of load and power factor. It happens that they are needed most between 6 a. m. and 8 p. m. W. H. Fraser asked whether steam turbo-generators could be used as synchronous condensers by disconnecting the steam end from the electric and running the generator idle on the line.

A. A. Miller inquired how frequently the 100-mile section of the line is grounded when repairs are being made. Interesting reminiscences on early conditions were given by M. H. Gerry and P. N. Nunn.

"Distribution System for Power Purposes" was read by the author, Mr. F. D. Nims. An abstract follows:

The paper describes the distribution system of the Western Canada Power Company, Limited, touching on the overhead and underground systems in general. It describes the advantages obtained by duplicating lines, both for eliminating outages and from a financial standpoint. Mention is made of the advantages obtained by using a steel-taped lead-armored cable placed directly in the ground, figures showing the exact cost of such an installation being given.

President Lincoln stated that he considered the use of armor cable the most important point developed in the paper, and asked if there were difficulty in locating faults and also remarked upon the trouble with heat from cables in duct. C. S. MacCalla cited his experience with electrolysis of armored cable laid in the ground at Sydney, Australia. Prof. H. V. Carpenter explained how he located faults by means of a telephone and coil of wire. Mr. Lincoln stated that his experience with this method had caused him to abandon it in favor of the Murray loop method. Mr. Nims stated that four cables to a trench was the maximum in his work, much of it being single cable. A megger was used in preference to the telephone method of locating faults. In conformity to the British Columbia regulations wood duct and cable are laid in concrete at railway crossings. He had experienced less trouble from electrolysis with a steel-armored lead sheath cable with jute between the armor and the sheath than with a lead-covered cable subject to the same conditions.

"Electricity in Lumber Industry" was read in abstract by the author, E. F. Whitney. The paper may be summarized as follows:

The development in the application of electric drive to the lumber industry has been exceptionally rapid. Successful sawmill companies are now even operating entirely from central station service, notwithstanding the large amounts of refuse available for fuel.

The paper considers the lumbering industry as carried on in Washington and Oregon, and describes the application of electric power to the various operations carried on under the two main divisions of logging and milling. Typical applications are described, to illustrate types of motors and power transmission equipments, and the average power demands of the various logging operations and milling processes. In addition to the machines used in ordinary sawmill work, those used in planing mills and shingle mills are described. The question of the disposition of waste is considered, and comparative fuel values are given. The illustrations show logging operations and electrically driven saws, finishing machinery and lumber-handling machinery in the Pacific Coast lumber districts.

Discussion was opened by R. F. Monges, who emphasized the importance of the lumbering industry as a likely consumer of hydroelectric power and also the assistance that electricity is giving the lumbermen.

A. A. Miller spoke of the recent change in the attitude of the mill man and the increasing application of electric drive. F. D. Weber told of practical experience with electric mill drive.

L. T. Merwin stated that the peak load in mill work should soon be overcome and inquired if flywheel storage of energy had yet been applied to regulate the power demand.

M. E. Cheney inquired if briquetting of sawdust had proven practicable in preventing this source of material waste.

Attila Norman stated that the load factor of the Booth-Kelley Lumber Company's new electrified mill is about 50 per cent. He believes that, generally speaking, a saw mill load will not be profitable to a central station.

W. H. Fraser stated that a British Columbia mill served with 750 to 1000 h.p. by a 9-mile 11,000-volt line had not caused serious voltage fluctuation to the town of Blaine, which is served by the same line.

J. Harisberger was optimistic as to the possibility of central station power service for mill work, both from the standpoint of cost to the consumer and of profit to the central station. He cited a mill having a 30 per cent load factor.

E. F. Whitney closed discussion by stating his belief in the future of mill electrification. Electrical logging requires good voltage regulation at the motor terminals and ample copper must be provided in the feeders, which are generally armored cable. The squirrel cage motor, which is usually employed in this service has a low fire risk. Slip-ring motors should be of the inclosed type. The average demand factor is about 70 per cent of the connected load and the load factor about 70 per cent of the demand factor. One mill showed a demand factor of 83 per cent and a load factor of 57 per cent with a connected load of 1550 h.p. The difficulty in getting a higher load factor is largely due to the light loading, for most of the time, of large motors driving head saws, edgers and other machines taking 200 h.p. and more. Load equalizers have met with indifferent success because of irregularity in load variations. The high cost of fly wheel regulators would not meet the approval of mill owners.

"Electrification of Butte, Anaconda & Pacific Railway" was read by the author, J. B. Cox, giving details of the construction and operation of this recently completed 1200 volt d.c. railway. This paper will be printed in full in an early issue of this journal.

Paul Lebenbaum opened the discussion by stating that the Portland, Eugene & Eastern Railway of Oregon operates an electric passenger service of 45,000 train miles per month, with steam service for freight, as yet. Pantograph rollers give a service of about 75,000 miles per roller, collecting from 100 to 150 amperes at 1500 volts.

J. B. Cox stated that the Butte, Anaconda & Pacific obtains 10,000 miles per roller collecting 600 amperes, there being two rollers to each locomotive. About 10 per cent of the mileage of this road is passenger service.

C. P. Kahler discussed Mr. Cox's statement as to the savings effected by electric operation.

Mr. Cox described the electric "tractors" ordered from the General Electric Company for freight service

as a suitable truck equipped with 1200 volt motors of the same size and speed as those on the locomotives. Each tractor is provided with weather protective housing but no cab or pantograph collectors. One tractor trails behind its locomotive as a tender behind a steam locomotive. On series points of the controller all six motors of the combined units are in series, and on multiple positions three motors are in series and the two sets in multiple.

"Application of Electric Motors to Gold Dredges" was read by G. B. Rosenblatt, the author, a brief summary of its salient features following:

Electric power has been applied almost universally to the operation of gold dredges of late, owing to its convenience and to the fact that hydroelectric power is available at very reasonable rates throughout the western states where gold dredging is carried on. There are a number of different motor applications on the elevator type of gold dredge, which is the type most generally used, and the author considers very fully the requirements of the various drives and the characteristics of the motors suited to the various operations of these dredges. Alternating current motors are generally used for these purposes and the type of control, which is of special importance, is considered. The paper also gives some figures on the cost of operation of dredges of different capacities.

M. H. Gerry stated that the real difficulty in applying electric motors to dredge service lies in an understanding of the conditions to be met. He spoke of the heavy construction necessary to give proper strength of many parts. He approved the use of liquid rheostats for large dredges, though grid resistances are satisfactory for smaller dredges. Messrs. Ross and Armstrong discussed the paper from a mining standpoint and R. A. Pope presented a contributed discussion from Ford W. Harris. Contributed discussion was also received from W. M. Shepard. A. A. Miller called attention to the increasing use of electric drive for gold dredging at Dawson.

G. B. Rosenblatt in closing the discussion agreed with Mr. Harris that d.c. motors are ideal for dredge service, excepting for the cost of converting a.c. The subject must be considered more from the mining than the electrical standpoint.

"Economy in the Operation of 55,000 Volt Insulators" was read by J. Harisberger in the absence of M. T. Crawford, the author. An abstract follows:

The author gives a brief outline of the operating experiences on three 55,000 volt lines, two of which have been in service 10 years and one 5 years. The quality of the more modern porcelain insulators is notably superior to those first installed on these lines. A device is described by means of which defective insulators can be readily detected in the very early stages of deterioration, and by periodic use of this device and replacement of insulators, failures in service have been practically eliminated.

The paper was discussed by V. H. Grieser, M. H. Gerry, A. A. Miller, H. R. Noack, L. T. Merwin, L. J. Corbett, R. M. Pope, M. Ross, W. H. Fraser and Ed. Woodbury, the consensus of opinion being that porcelain is inert material not subject to aging. Standard specifications for "a perfect porcelain" are not available.

"Report on Induction Interference" by the joint committee to the Railroad Commission of the State of California, was read by L. P. Ferris, assistant engineer in charge. This paper is now appearing serially in this

journal, and as can be noted comprises a series of recommendations as to means of minimizing inductive interference to telephone lines from power circuits.

The discussion was opened by P. N. Nunn who in no uncertain terms voiced the feeling of the power companies that this report is vicious and unjust. A more extended summary of Mr. Nunn's views appear on the editorial page of this issue.

J. B. Fiskien brought forth several absurdities which would result in the practical application of the provisions of this measure. A. H. Halloran suggested that the power companies had frequently been an aggressor, that the telephone companies had spent thousands of dollars in vainly trying to devise physical protection and that their plight was worthy of fair consideration.

A communicated discussion was read from A. J. Bowie, who showed that the prohibition of the air-break switch would greatly increase costs to the power companies. He also presented facts and oscillographs tending to prove that air-break switches caused less severe disturbances than oil switches. He concluded with a request that more experiments should be undertaken so that this prohibition might be based upon something more substantial than a "commonly recognized fact."

Geo. S. Humphrey quoted the action of the N. E. L. A. at their recent convention whereby the provisions as to overhead crossings had practically been abrogated. J. C. Martin questioned the 5000 volt limitation in view of the operation of many 6600 volt distributing lines which are not known to be causing trouble. L. J. Corbett believed that a better term than "residual" could have been employed. L. T. Merwin characterized the paper as an insult to the power companies and demonstrated how he had eliminated all trouble on telephone lines by neutralizing the effects of power circuits by means of reactances and condensers at the telephone instrument, which was equipped with a high power transmitter.

L. P. Ferris, in closing the discussion made no attempt to defend the report against the caustic criticism which it had received and merely discussed the meaning of some of the definitions.

President Lincoln then announced the adjournment of the Pacific Coast meeting of the American Institute of Electrical Engineers.

Space forbids a full report on the papers and discussions of the meeting of the Northwest Electric Light & Power Association, but these will be published in early issues of this journal.

Chinese electric light plants are increasing in number. A local Hong Kong electrical firm has obtained the contract for supplying the machinery for an electric light plant at Kongmun, Kwangtung Province, which will cost about \$5200 gold. The engines are of Swedish manufacture and the other parts are German. The monopoly for furnishing electric current at Kongmun will soon expire, and the new company will take over this monopoly as soon as its plant is ready. The same Hong Kong company has already furnished the equipment for plants at San Choung, Sunning district, and also at Sunning City, the former costing about \$4200 gold and the latter \$7250 gold. The cost of erecting a building of the kind required is about \$400 gold.

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The report on inductive-interference-now appearing in these columns essentially constitutes a number of recommendations whereby power companies may be able to keep a proper balance of power in circuits paralleling telephone wires.

The Balance of Power

Viewed as a scientific study of physical conditions it is a document of great worth. But viewed from the standpoint of an operating power company it seems to throw the balance of power so strongly in favor of the telephone company that there promises to be a lively war in order to effect a readjustment.

The standpoint of the power company was shown in merciless style by R. N. Nunn, chief engineer of the Telluride Power Company, in the course of the discussion which this report provoked when presented at the Spokane meeting of the American Institute of Electrical Engineers. Mr. Nunn charged that what purports to be a mutual study and action for the general good is a box subtly designed to trap the power companies, with the back door open for the telephone company to get in and out at will. His cutting analysis and caustic comment on each requirement demonstrated that the burden of correction is laid upon the power companies. He claimed that some of the provisions involved such a great expense as to practically prohibit operation in many cases. By innuendo and direct accusation he charged the organized telephone interests with having "put this over" on the individual power companies. He prophesied that what has been a local question in California will become a national controversy and in vigorous language he denounced it as a "Bell scheme" opposed to the power industries of the country.

Other participants in the discussion were no less scathing in their denunciation of the report, particularly as its recommendations have been adopted as a general order by the Railroad Commission of California, which body has furthermore made them retroactive. Judging from past experience it is presumed that the report will be made the basis for similar orders by the other commissions. The power representatives were unanimous in the belief that the regulation will greatly restrict power development.

Unfortunately no member of the committee was present to answer these attacks. The representative of the committee wisely refrained from a rebuttal, leaving the defense to written communications at some later date. The feelings which the recommendations engendered were so bitter that but scant consideration was given to the scientific aspect and to the great value of the investigation in portraying phenomena about which little has been known heretofore.

An unbiased observer cannot but think that the power companies were the original innocent aggressors. The telephone antedates the transmission of power and telephonic as well as telegraphic communication has suffered from inductive interference. Great sums of money have been spent in experiments to devise some sort of protection against this interference but the engineers have met with little success. It

therefore hardly seems just that the power companies be asked to assume most of the responsibility and cost in obviating these difficulties.

Strong confirmation has been given to a suggestion recently advanced in these columns that a rate based upon the cost of service virtually abrogates the artificial effort of public service commissions to supersede destructive competition by means of regulated monopoly.

In the course of an address at the recent joint convention at Spokane W. W. Cotton forecasted the effect of such a method of rate-making upon electric utilities from the results that similar regulations have already brought about for the railroad companies. After tracing the change in sentiment since 1894, when the railroads were regarded as private properties entitled to name a reasonable charge for their services, he showed that thirty-five per cent of the railroads are gradually being confiscated by the present "near-confiscation" method of rate-making.

The measure of rate value is a "fair return." Less is confiscation. A fair return to a new competing company may put its older rival out of business. Thus a reasonable return and no more may eventually result in confiscation. This is graphically illustrated by the results in prescribing the same food rations for several men with different powers of digestion and assimilation. One man may starve to death on what is enough to fatten another. No two utilities can have the same cost, and on this theory a reasonable return on the investment of one may constitute confiscation of the other.

As an alternative to this method Judge Cotton suggests that the reasonableness of the rate be estimated from the standpoint of the person served, that rates be based upon the value of the service rather than its cost. If undue earnings are found to accrue under this method he proposes that the commission draw a draft against the company at the end of the year.

Readers will readily call to mind other remedies which have been proposed to obviate the injustice of a rate based upon the cost of service, a rate which puts a premium on high costs of construction and poor management. Many valuation engineers prefer the theory of "reproduction cost new," which the California Commission frowned upon in the Antioch rate case. In the light of present day efforts for efficiency and scientific management it certainly seems an anachronism to make rates on a basis which encourages inefficiency and high costs.

The great lesson to be drawn from Judge Cotton's remarks is that the electric utilities should profit from the bitter experience of the railroads. They should go before the tribunal of public opinion and present their side of the case before it is too late. The immediate problem is essentially one of education. It is necessary to inform legislators and commissioners of the facts. The injustice of the past is one of igno-

rance rather than wilfulness. The danger of the future is that the companies will lose by default.

We often speak figuratively of the power of money without a full appreciation of the literal aptness of this expression. Adopting the hydraulic analogy, the stream of coin that is poured forth each year from the mints may well be likened to a stream of water fed from the clouds. Both run to waste unless properly conserved and controlled so as to perform useful work. Whether stored in mountain reservoirs or in bank vaults, their energy is but potential until the gates have been opened and these quantities are set in motion by some such force as the attraction of gravitation or of interest. It may seem novel to think of interest as a force, but in the power equation of money it is invaluable. It is much like gravity, in that its effect is greatly accelerated when compounded. Conducted through the proper channels, it is money that keeps the wheels of industry in motion, and so in time money thus becomes power.

Judging from the press despatches of each day, we find the supply of money for current purposes gradually lessening. This is caused by the conservation of gold by each of the warring nations. As Premier Asquith most aptly stated, the last hundred millions might be the deciding factor of this awful conflict. Money is the great power behind the army, and during these depressing times, it is natural that a lack of confidence be shown, even in America's gilt-edged securities. The support of the great investing public has been withdrawn to a certain extent, and the professional buyer is tempted only by the bargain counter. This icy barrier of distrust will remain until melted by the warming rays of renewed confidence. The stored money of the small investors will be withheld. It is difficult to induce a man to put his savings into a proposed hydro-electric development or new manufacturing interest in times such as these, and yet the warning has been given to the American people by the most conservative statesmen and financial men that we must prepare for the harvest. The old adage,—*"It is an ill wind that blows nobody any good,"* is exemplified in the terrible cyclone of devastation that is sweeping the countries of Europe. America at present is calm, but it is the calm before the storm. A great business revival seems to be in the air everywhere.

To supply the demands for South America, Mexico and the Orient, the Pacific Coast is the logical manufacturing base. Now that our merchant marine is an assured fact, raw material will be as accessible to the Coast as it has been to the East. A great mass of foreign craftsmen will be driven from their homes on account of ruined factories, impoverished employers and the general disorganized condition, and will flock to this great land of liberty to find a market for their skill. Are we prepared for them, or will we be prepared for them when the time comes?

The Power of Money

Near-Confiscation

PERSONALS

R. L. St. John, electrical contractor, San Diego, spent the week in San Francisco.

F. G. Beck, auditor American Every Ready Company, San Francisco, has returned from his vacation in the Sierras.

Geo. R. Thomson, representing R. J. Davis, sales agent for Century motors, is visiting towns in Central California.

W. I. Otis, electrical manufacturers' representative at San Francisco, is on a business trip throughout the Sacramento Valley.

M. L. Orcott, general manager of the California Glass Works, Los Angeles, was a visitor to San Francisco during the week.

H. L. Strange, general manager Honolulu Gas Company, and secretary Honolulu Ad. Club, is a recent visitor at San Francisco.

A. J. Pahl, manager K. P. F. Electric Company, left for Chicago last Saturday and expects to remain in the East about six weeks.

A. G. Wishon, general manager San Joaquin Light & Power Company, Fresno, California, is spending a few days in San Francisco.

A. H. Griswold, engineer of outside plant for the Pacific Telephone & Telegraph Company, has returned to San Francisco from New York City.

J. O. Corbett, sales representative of the Economy Fuse and Manufacturing Company, Chicago, spent several days during the week in San Francisco.

P. B. Hyde, representative of Thos. A. Edison Company, San Francisco, returned to the city this week after an extended trip through the Southwest.

James F. Rogan, Southern California representative of the Edison Storage Battery Company, at Los Angeles, is spending the week at San Francisco.

Dr. Thomas Addison, Pacific Coast manager General Electric Company, is making a business trip throughout the East and is expected to return in about a month.

Patrick Longon, controller Mt. Whitney Power & Electric Company, Visalia, Cal., is at San Francisco, accompanied by **Fred Hamilton**, Eastern district manager.

H. N. Lauritzen, Pacific Coast manager Holophane Works of the General Electric Company, has returned to San Francisco from a short business trip in Los Angeles.

H. C. Goldrick, Pacific Coast sales manager Kellogg Switchboard & Supply Company at San Francisco, returned from a business trip throughout the Southern part of the State.

T. A. Marshall, formerly with the De Lavel Dairy and Faget Engineering Company, is now chief refrigeration engineer with the American Ever Ready Company in San Francisco.

J. S. Baker, Pacific Coast manager Crocker-Wheeler Company, San Francisco, is making a two weeks' trip in the Northwest, where he will visit Portland, Ore., Seattle, Wash., and Vancouver, Wash.

Herbert C. Law, of the Brookfield Glass Company, New York, spent a portion of the week in San Francisco, leaving for a few days' stay in Los Angeles prior to attending the coming Jobbers' Convention at Del Monte.

E. M. Fraser, consulting engineer of the Van Emon Elevator Company of San Francisco, is at Vancouver, B. C., putting the final touches on a battery of five gearless traction elevators in the Standard Bank Building.

R. F. Oakes, president American Ever Ready Company of San Francisco, left for New York on business, and while in the East will visit the company's plants at Niagara Falls, Fremont, Fostora, New Jersey, and Toronto. He expects to be gone about three months.

L. A. Gain, electrical engineer, for five years associated with the Western Canada Power Company in designing and construction work, is a visitor in San Francisco. Mr. Gain is hopeful of making business connections that will permit him remaining permanently in this vicinity.

Franklin Overbaugh, secretary, and **T. M. Debevoise**, counsel of the Electrical Supply Jobbers' Association, will attend the meeting of the Pacific Coast Electrical Supply Jobbers' Association at Del Monte next week. Advance registration already indicates the success of this meeting.

John Young, dean of the Engineers' School, Hawaii, formerly consulting and constructing engineer with the Westinghouse, Church, Kerr Co., New York, and a past president of the Hawaiian Engineering Association, spent several days in San Francisco, recently, on his homeward trip from the East.

Charles H. Lee, consulting engineer of Los Angeles, has been engaged by the Ground Water Division, Water Resources Branch, U. S. Geological Survey, to carry on comprehensive investigations of ground water supply throughout the Pacific Slope drainage of San Diego county. Mr. Lee will maintain his engineering offices in the Central Building where he will continue his consulting engineering practice.

REGISTRATION AT SPOKANE CONVENTION.

Following is a list of those registering at the meetings of the Northwest Electric Light & Power Association and the Pacific Coast Convention of the American Institute of Electrical Engineers at Spokane, September 9-10-11:

Douglas Allmond, Anacortes.	J. G. Finley, Spokane.
L. A. Addison, Spokane.	Chas. M. Fisher, Spokane.
M. K. Akers, Pullman.	Mrs. J. B. Fiskens, Spokane.
L. P. Anstin, Spokane.	Miss Ruth Fiskens, Spokane.
E. Baughm, No. Yakima.	John B. Fiskens, Spokane.
E. L. Blaine, Spokane.	Robt. A. Foster, Clarkston.
H. L. Bleecker, Spokane.	M. H. Gerry, Jr., Helena.
F. S. Burroughs, Olympia.	V. H. Greisser, Spokane.
R. C. Bailey, The Dalles.	H. V. Gates, Portland.
P. A. Bertrand, Aberdeen.	S. E. Gates, Spokane.
C. A. Brown, Seattle.	Henry L. Gray, Seattle.
Mrs. C. A. Brown, Seattle.	A. B. Gates, Spokane.
J. W. Beyer, Spokane.	W. J. Grambs, Seattle.
J. P. Byron, Spokane.	W. C. Giles, Spokane.
M. J. Bottinelli, Kellogg.	H. C. Gram, Everett.
H. P. Burke, Spokane.	Jay S. Gros, Portland.
M. W. Birkett, Spokane.	Arthur Gunn, Wenatchee.
Mrs. M. W. Birkett, Spokane.	Robert Gray, Spokane.
George A. Boring, Portland.	J. W. Geary, Spokane.
N. W. Brockett, Seattle.	Dwight F. Henderson, Spokane.
E. M. Brummer, Spokane.	Mrs. D. F. Henderson, Spokane.
B. C. Burdick, Portland.	G. R. Hall, San Francisco.
H. J. Billiea, Spokane.	A. H. Halloran, San Francisco.
Mrs. H. C. Billiea, Buffalo, N. Y.	Geo. S. Humphrey, Salt Lake City.
Miss Grace Billiea, Buffalo, N. Y.	John Harisberger, Seattle.
S. W. Boyles, Spokane.	W. R. Hendry, Seattle.
F. L. Bargion, Spokane.	J. C. Huffman, Chicago.
Mrs. H. L. Bargion, Spokane.	R. Dean Hart, Spokane.
W. L. Chvrsler, Willbur.	G. H. Hoppin, Spokane.
J. W. Conluf, Spokane.	Mrs. G. H. Hoppin, Spokane.
H. V. Carpenter, Pullman.	J. W. Hungate, Spokane.
L. J. Corbett, Moscow.	Mrs. J. W. Hungate, Spokane.
Mrs. L. J. Corbett, Moscow.	T. E. Holsey, Spokane.
V. P. Campbell, Spokane.	M. Hunter, Spokane.
C. E. Condit, Portland.	Percival Hall, Spokane.
Leslie F. Curtis, Seattle.	Mrs. Percival Hall, Spokane.
O. B. Coldwell, Portland.	D. S. Hays, Portland.
T. R. Cornick, Vancouver.	J. C. Henkle, Portland.
A. U. Carlson, Spokane.	W. E. Herring, Seattle.
Stanley Corey, Spokane.	W. A. Howcroft, Herrington.
Mrs. Stanley Corey, Spokane.	G. Hamilton, Portland.
J. J. Curran, Spokane.	A. S. Hall, Hood River.
Mrs. J. J. Curran, Spokane.	H. C. Hagganmiller, Spokane.
F. V. Cook, Marshfield.	J. R. Ingersoll, Spokane.
A. M. Chitty, Wenatchee.	F. A. Jeter, Spokane.
Wm. C. Cook, Spokane.	H. C. James, Tacoma.
A. B. Cornwell, Spokane.	John A. Jennings, Lewiston.
J. B. Cox, Schenectady.	R. E. Jones, Metaline Falls.
M. E. Cheney, Seattle.	Mrs. Wilson Johnston, Spokane.
W. D. Conover, San Francisco.	J. H. Jamison, Spokane.
Elmer Dover, Tacoma.	G. H. Jeat, Portland.
L. W. Davis, Butte.	E. F. Keyes, Sunnyside.
R. S. Daniels, Spokane.	Chas. P. Kahler, Salt Lake City.
Mrs. R. S. Daniels, Spokane.	J. B. Kilmore, Astoria.
W. L. Davies, Vancouver.	J. M. Kincaid, Portland.
D. K. Dalzell, Spokane.	A. L. Kearns, Seattle.
J. E. Davidson, Portland.	R. C. Kennedy, Wenatchee.
S. Dowitt, Spokane.	C. S. Knowles, Portland.
D. F. Dunn, Vancouver.	L. E. Keene, Denver.
D. P. Dunn, Chilliwack.	Carl C. Long, Grace.
H. L. Eicher, Seattle.	A. Lindsay, Spokane.
C. H. Fletcher, Vancouver.	P. M. Lincoln, Pittsburg.
Mrs. C. H. Fletcher, Vancouver.	R. W. Lindley, Bellingham.
L. P. Ferris, San Francisco.	L. A. Lewis, Spokane.
H. C. Fiske, Spokane.	L. C. LaMont, Butte.
W. H. Fraser, Vancouver.	Mrs. L. C. LaMont, Butte.
Y. P. Foster, Philadelphia.	Chas. A. Lund, Spokane.
Miss H. A. Foster, Philadelphia.	Paul Lehenbaum, Portland.
T. L. Foster, Philadelphia.	C. A. Lemmon, Anaconda.

E. A. Lindsley, Seattle.
 R. W. Lindley, Bellingham.
 D. Lewis, Pomeroy.
 G. D. Longmuir, Pasco.
 H. G. Miller, Spokane.
 Mrs. H. G. Miller, Spokane.
 E. L. Morse, Spokane.
 A. A. Miller, Seattle.
 Mrs. A. A. Miller, Seattle.
 C. W. Miller, Spokane.
 R. F. Monges, Portland.
 J. C. Martin, Portland.
 Mrs. J. C. Martin, Portland.
 Ronald Martin, Portland.
 H. I. Melvin, Pullman.
 R. U. Muffley, Bellingham.
 L. T. Merwin, Portland.
 C. C. Marsh, Spokane.
 N. E. Moore, Coeur d'Alene.
 Mrs. C. A. Mason, Spokane.
 A. J. Mayham, Spokane.
 J. W. Moss, Spokane.
 D. W. Marshall, Spokane.
 H. A. Mott, Dayton.
 C. S. MacCalla, Spokane.
 R. B. McElroy, Spokane.
 Jas. S. McNair, Spokane.
 Mrs. C. L. MacCalla, Spokane.
 M. McCain, Spokane.
 Lewis A. McArthur, Portland.
 D. C. McKissick.
 H. R. Noack, San Francisco.
 L. R. Norman, Spokane.
 Mrs. L. R. Norman, Spokane.
 F. D. Nims, Vancouver.
 John Nordmark, Nine Mile Falls.
 Mrs. N. A. Naylor, Goldendale.
 Geo. Nixon, Spokane.
 P. N. Nunn, New York City.
 P. H. Neuman, Spokane.
 Mrs. P. H. Neuman, Spokane.
 A. Norman, Eugene.
 J. C. Neylor, Goldendale.
 M. C. Osborn, Spokane.
 Bernhard Olsen, Spokane.
 F. B. Olds, Spokane.
 Ralph W. Pope, Elizabeth.
 L. J. Pospisil, Spokane.
 H. E. Plank, Seattle.
 J. H. Paget, Vancouver.
 Max C. Passler, Spokane.
 H. B. Peirce, Spokane.
 L. N. Rice, Spokane.
 Mrs. F. L. Rohrbach, Spokane.
 E. G. Robinson, Arlington.
 Mrs. E. J. Robinson, Arlington.

Foster Russell, Spokane.
 A. J. Ruel, Sand Point.
 V. W. Russell, Spokane.
 E. E. Royer, Spokane.
 C. D. Rancy, Pullman.
 G. B. Rosenblatt, Salt Lake City.
 A. A. Rohde, Spokane.
 F. E. Ryan, Spokane.
 Geo. N. Roobu, Sand Point.
 W. G. Stearns, Portland.
 H. A. Stummel, Spokane.
 I. B. Solberg, Spokane.
 V. G. Shinkle, Spokane.
 E. D. Searing, Portland.
 W. K. Stacy, Spokane.
 W. C. Siyer, Spokane.
 S. E. H. Smith, Vancouver.
 N. H. Silver, Seattle.
 H. C. Swann, Spokane.
 Mrs. H. C. Swann, Spokane.
 I. A. Shorno, Spokane.
 Mrs. I. A. Shorno, Spokane.
 W. E. Sholl, Wallace.
 W. D. Scott, Portland.
 A. V. Steel, Spokane.
 Wm. F. Sachleben, Bremerton.
 J. D. Scott, Portland.
 L. W. Sherman, Portland.
 Bert L. Siyer, Okanogan Valley.
 N. L. Scott, Spokane.
 Geo. C. Sawyer, No. Yakima.
 J. V. Strange, Prosser.
 J. E. Shinn, No. Yakima.
 L. M. Shreve, Wenatchee.
 L. W. Simpson, Spokane.
 H. P. Thomas, Nelson.
 Frederic Tappan, Vancouver.
 W. H. Trenner, Boise.
 S. W. Thompson, Spokane.
 R. E. Tompkin, Spokane.
 L. P. Tevis, New York.
 J. B. Thornton, Raymond.
 C. F. Uhlen, Spokane.
 Geo. W. Uzzell, Spokane.
 Fred. D. Weber, Portland.
 Mrs. F. D. Weber, Portland.
 Edward Woodbury, Los Angeles.
 H. B. Waters, Boise.
 Carl L. Wernicke, Portland.
 E. S. Whitney, Portland.
 C. M. Wright, Spokane.
 J. M. White, Spokane.
 H. S. Wells, Portland.
 R. W. Whiffey, Bellingham.
 E. A. West, Portland.
 Chas. Young, Spokane.

and J. F. Skigland. A Transmission and Absorption Photometer for Small Areas (to be read in title)—P. G. Nutting and L. A. Johns.

Afternoon Commercial Session 2:00 to 5:00.

Recent Improvements in Incandescent Gas Lighting—R. F. Pierce. Characteristics of Gas-Filled Lamps—G. M. C. MacKay. The Lighting of Rooms through Translucent Glass Ceilings.

Afternoon Laboratory Session 2:00 to 5:00.

Mixed Specular and Diffuse Reflection—P. G. Nutting. Notes on Integrating Sphere and Arc Lamp Photometry—N. K. Chaney and E. L. Clark. A New Standard Light Source (to be read in title)—L. A. Jones. Some Tests of Possible Reflecting Power Standards (to be read in title)—P. G. Nutting, L. A. Jones and F. A. Elliott.

Thursday, September 24th—Morning Session 9:00 to 12:30.

Some Uses of Light in the Treatment of Disease—E. C. Titus. Some Experiments with the Ferreo Test for Eye Fatigue—J. A. Cravath. Further Experiments on the Efficiency of the Eye Under Different Conditions of the Lighting—C. E. Perree and G. Rand.

Afternoon or Evening Session 7:30 to 8:30.

The Visibility of Radiation—P. G. Nutting. Some Recent Experiments on Vision in Animals—H. M. Johnson.

The program of entertainment arranged for by the committee of which Mr. C. L. McKinstry acts as chairman, is as follows:

September 21, 1914—Monday Afternoon:

Tea and social afternoon for the ladies at Hollenden Hotel.

Monday Evening:

Formal reception and ball for ladies and gentlemen, Hollenden Hotel.

September 22, 1914—Tuesday Afternoon:

Trip to Women's Clothing Factories for ladies. Lunch at factory.

Tuesday Evening:

Popular lecture at Chamber of Commerce Building for ladies, gentlemen and their friends.

September 23, 1914—Wednesday Afternoon:

Luncheon and Bridge at some Country Club for the ladies.

Wednesday Evening:

Banquet, Hollenden Hotel for ladies and gentlemen.

September 24, 1914—Thursday Afternoon:

Trip to Nela Park, supper and evening entertainment for ladies and gentlemen.

San Francisco Jovians.

A large and enthusiastic meeting of the Jovians was held Tuesday, September 15th. After transaction of the regular routine business, the speaker of the day, Mr. H. H. Cudmore of the Mazda Bureau, was introduced and addressed the gathering on the subject of "Co-operation." It was decided to accept the speaker's offer to conduct a smoker on the evening of Jovian Day in October, details of which are to be announced later. Talks were also made by J. O. Corbett, R. L. St. John and several others.

Engineers' Club of San Francisco.

At the bi-weekly luncheon of the Engineers' Club on September 16, T. W. Ransom, mechanical engineer for the Board of Public Works, gave an interesting address on San Francisco's municipal street railways.

On August 26, 1913, bonds were authorized to the amount of \$3,500,000 for the construction of municipal street railways. During the year detailed plans and specifications were prepared and contracts were entered into for the following:

Construction of Van Ness avenue line from Market to North Point street, on Chestnut street from Van Ness avenue to Scott street; thence in Scott street to Greenwich street; thence to Steiner street, where connection was made to the tracks of the Union street line; total length 3.26 miles. This was completed and put in operation August 15, 1914.

Potrero avenue line from Market street, along Eleventh street to Division street, along Division street to Potrero avenue and on Potrero avenue to Twenty-fifth street. This contract was completed September 1, 1914, and was in operation September 7, 1914. Length 1.99 miles.

Union street line.—This line was purchased from the Presidio & Ferries Railroad Company for the value as appraised by the City Engineer, and operation commenced December 11, 1913. Length 3.9.

MEETING NOTICES.

Eighth Annual Convention Illuminating Engineering Society, Cleveland, Ohio. September 21 to 26, 1914.

All preparations have been completed for the reception of delegates and guests at the coming convention of the Illuminating Engineering Society to be held in Cleveland, September 21st to 26th. The Hollenden Hotel has been selected as Headquarters where reservations may be made direct by delegates and guests or, should they prefer doing so, requests may be made for reservations through the chairman of the Hotel Committee, Mr. A. G. Summerell, who can be addressed care National Carbon Company, Cleveland, Ohio.

PROGRAM.

Monday, September 21st—Morning Session 10:30 to 12:30.

Opening meeting for ladies and gentlemen. Assembly. Address of Welcome. Response. Presidential Address—C. O. Bond. Report of Committee on Progress. Report of the Committee on Research.

Afternoon Session 2:00 to 5:00.

Color of Illuminants—L. A. Jones. Artificial Daylight: Its Production and Use—M. Luckiesh and F. E. Cady. Development of Daylight Glass—E. J. Brady.

Tuesday, September 22d—Morning Session 9:30 to 12:30.

Relation of Light to the Critical Inspection of Documents—A. S. Osborn. Planning for Daylight and Sunlight in Buildings—L. B. Marks and J. E. Woodwell. Air-Shaft Illumination as Studied by Models—C. H. Sharp.

Evening Lecture Session 8:15 to 10:15 p. m.

Photo Sculpturing and the Use of Light in the Reproduction and Illumination of Sculpture—John Hammond Smith. Color Photography—M. C. Rypinski.

Wednesday, September 23d—Morning Commercial Session 9:30 to 12:30.

The Locomotive Headlight—J. L. Minick. Present Practice in the Use of Tungsten Filament Lamps for the Lighting of Metal Working Plants—A. L. Powell and R. E. Harrington. Factory Lighting. Cost Maintenance and Installation Cost.—O. R. Hogue and A. O. Dickers.

Morning Laboratory Session 9:30 to 12:30.

Light Filters for Use in Photometry—C. E. K. Mees. Experiments with Colored Absorbing Solutions for Use Heterochromatic Photometry—H. E. Ives and E. F. Kingsbury. Characteristic Equations of Tungsten Filament Lamps and Their Application in Heterochromatic Photometry—G. W. Middlekauff

Stockton street line.—From Market street along Stockton street to Columbus avenue, where connection will be made with the Union street line. The line is now under construction and will be completed about October 10, 1914. Length 0.97 mile.

Masonic avenue extension.—This is an extension to the Geary street line and extends from Geary street to Turk street and was built to facilitate traffic to the new baseball park. Length 0.26 mile.

Plans are being prepared for an extension on Columbus avenue from a connection with the Union street line to North Point street; thence to Van Ness avenue, and thence to Chestnut street to connect with the Van Ness avenue line; also an extension through the Fort Mason Military Reservation to Laguna street at an entrance to the Exposition grounds.

Plans are also in preparation for the construction of the California street line from Thirty-third avenue to Second avenue, thence to Geary street to connect with the Geary street line; also for a line on Church street.

Contracts have been made for 125 street cars and of this number 36 have been delivered by September 1st. Contracts have been let for the enlargement of the Geary street car barn and plans made for a new structure for car storage at Seventeenth, York and Hampshire streets.

On August 10, there had been expended from the Municipal Railways construction fund the sum of \$1,070,038.51.

He further detailed the efficient organization whereby this work has been accomplished.

NEWS OF WASHINGTON PUBLIC SERVICE COMMISSION.

The Washington Public Service Commission will hold an important session in Seattle beginning with September 30, to take up various matters. The first question to be considered will be the Twenty-first street car service. On October 5th the adjustment will have to do with the protest of Phinney avenue residents against "Ballard" designation in the telephone directory; October 6, protest against Seattle-Everett toll rates of Pacific Telephone & Telegraph Company; October 8th, arrangement of transfer exchanges between municipal car line and Seattle, Renton & Southern and Puget Sound Traction, Light & Power Company. On October 20 the commission will sit at Port Townsend to consider complaints against the electric light rates charged by the Key City Light & Power Company, and during the same week will have a hearing at Everett on gas and electric rates.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Western States Gas & Electric Company, operating in San Joaquin, Humboldt, Sacramento, Calaveras, Amador, El Dorado and Contra Costa counties, has filed an application asking permission to create a three-year 6 per cent note issue in the sum of \$1,500,000 to be secured by a trust deed of all the company's properties.

The Commission has rendered a decision granting the Lindsay Home Telephone and Telegraph Company of Lindsay, Tulare County, authority to issue a promissory note of the face value of \$2000 for a term not exceeding five years.

The Commission has rendered a decision authorizing the Northern California Power Company, Consolidated, to issue \$22,000 in promissory notes for the purpose of refunding other notes outstanding.

The Commission has made a supplemental order authorizing the Southern Counties Gas Company of California to execute a mortgage on its property in the form of a deed of trust to the Central Trust Company of Illinois and William T. Abbott of Chicago.

The Snow Mountain Water and Power Company has filed an application with the Commission asking authority to transfer and lease a portion of its property to the California Telephone and Light Company. The latter company requests authority to issue a promissory note amounting to \$790.18 in return therefor.

The Commission has rendered a decision extending the time in which the Santa Barbara Gas & Electric Company may issue \$100,000 of 6 per cent bonds from August 1, 1914, to December 31, 1914.

The Commission has rendered a decision authorizing the Pacific Gas & Electric Company to issue \$1,000,000 of its general and refunding mortgage gold bonds. The company proposes to pledge these bonds to secure its sureties on two bonds which it must file in the District Court of the United States in connection with suits brought to enjoin the enforcement of the gas and electric rates fixed by the Board of Supervisors of San Francisco for the year ending June 30, 1914.

The Contra Costa Gas Company has filed an application with the Commission asking authority to issue twenty shares of its capital stock to S. Waldo Coleman; to issue 591½ shares of capital stock, and to create a bonded indebtedness of \$500,000, and to issue \$109,000 par value of said bonds.

The Hughson Telephone Company, operating in Hughson, Stanislaus County, has filed an application with the Commission asking authority to issue 5000 shares of common stock at \$1.00 per share.

The San Joaquin Light & Power Corporation has filed an application with the Commission asking authority to renew certain promissory notes totaling \$44,156.48, for a period not exceeding one year from date of maturity.

TRADE NOTES.

The first Cutler-Hammer electric steering gear in a foreign navy is on the Greek battleship *Kilkis*. This ship which has been purchased from the United States was formerly the U. S. S. *Mississippi*. The *Kilkis* is reported as having arrived safely at Athens.

The Capital Electric Company of Salt Lake City has been awarded the contract for installing the electric conduit and wiring in the new Dee-Eccles Building now in the course of erection. The entire top floor of the building will be devoted to a dance hall 90x120 feet which will be lighted entirely by indirect cove lighting.

A five-year contract was recently made by the Booth-Kelly Lumber Mill at Springfield, Oregon, with the Oregon Power Company for the complete operation of the lumber mill by electric power. The inauguration of electric service at this mill is an epoch in the lumber history of Oregon in that it is the first electrically operated mill in the state.

Evans-Dickson Company, consulting engineers and contractors, Tacoma, are installing a small water power plant for the Montazuma Coal Mines Company at Fairfax, Washington; are doing the electric work in the Oregon-Washington freight sheds at Tacoma and furnishing an electric cooking outfit for the Kapowsin schools at Kapowsin, Washington.

The Capital Electric Company were awarded the contract by the Utah State Capitol Commission for the furnishing and installation of a 100 kilowatt General Electric motor generator set which will be used in supplying direct current service for the operation of the passenger elevators and some other direct current power equipment to be located in the new State Capitol building. This motor generator is made necessary by the fact that the Capitol Building is located so far outside of the Utah Light & Railway Company's direct current distributing system, that it was not advisable to extend their mains to it.

The scarcity of ferro-manganese in America, due to cessation of shipments from continental Europe, has resulted in resumption of activity at the Heroult electric smelter. The company operating the plant, the Noble Electric Steel, owns a vast deposit of high grade manganese a short distance from Heroult, and has proven its ability to produce ferro-manganese with the electric furnace. The first furnace has been, and the second will be blown in within a few days. More units will also be placed in commission. Chromium will also be produced. The company has placed a large force at work in the iron

mines along Pit River, and heavy shipments of crude ore to the plant over the aerial tramway will soon be in order. The company for years has been endeavoring to produce pig iron, but costs have proved so large, coupled with smelting troubles, that several months ago all work was suspended and the company faced a severe loss. The outbreak of war in Europe has changed all this, and the management is convinced that next year will prove a highly profitable one.

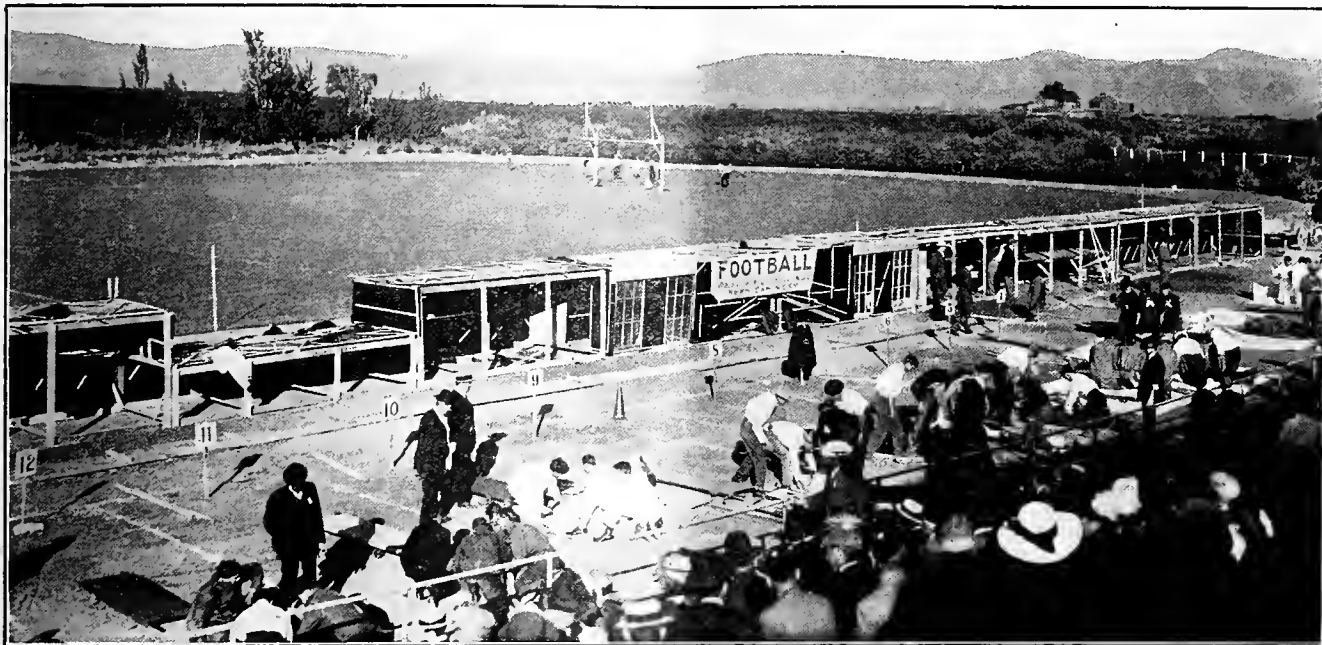
NEVADA FIELD MEET.

A field meet between first aid teams from several railroads, mines and power plants was the feature of the Labor Day celebration at Reno, Nevada. This meet was held under the direction of J. G. Scrugham, dean and professor of mechanical engineering at the University of Nevada, who has

In the miner's first aid contest the problem was: Miner found in drift under fall of rock in contact with electric wire; rescue patient and restore breathing; patient suffering from following injuries: deep electric burn on small of back; scalp wound and left eye ball cut; severe bleeding; right collar bone fractured and simple fracture of right forearm; compound fracture of right thigh 5 inches from knee; severe bleeding; time, 25 minutes.

The winners in the miners' contest were: First prize, Nevada Consolidated Copper Company (McGill concentrator team), score 100 per cent; second prize, Tonopah Extension; third prize, Tonopah Belmont; fourth prize, West End Consolidated and Goldfield Consolidated, tied.

One of the interesting events of the day was the demonstration made by E. P. Cullinan, chief electrician of the Bel-



Teams in Electric Accident Contest.

organized first aid and rescue teams in every industrial establishment of any importance in Nevada.

The mine rescue contest was held between teams from the Tonopah Mining Company, the Nevada Consolidated, the Tonopah Belmont and the Goldfield Consolidated, awards being allotted in the order named.

In the railroad and power plant first aid contests teams were entered by the Southern Pacific Company, Nevada-California-Oregon Railway, Nevada Northern Railway, Virginia & Truckee Railway, Reno Power, Light & Water Company, Truckee River General Electric Company and the University of Nevada Electrical Engineering Department. The problem to be handled was:

Wreck on electric road; man found with right forearm in contact with trolley wire and severely burned; left leg cut off 2 inches above knee; deep cut on back of head; severe bleeding; simple fracture of left wrist; time, 25 minutes.

In the contest the first prize was awarded to the Nevada-California-Oregon Railway; second prize, Southern Pacific Railway; third prize, Virginia & Truckee Railway; fourth prize, Nevada Northern Railway.

The accompanying illustration shows the teams engaged in the contest, reading from left to right: Truckee River General Electric Company, Reno Power, Light & Water Company, Southern Pacific Company, University of Nevada Electrical Engineering Department, University of Nevada Mining Engineering Department, Goldfield Consolidated, McGill Concentrator and Nevada-California-Oregon Railway. The structure shown in the rear is part of model of a mine drift, 250 ft. long in which the mine rescue tests were held.

mont Development Company of Tonopah, of his method by which one man can carry two unconscious men from a mine, although the burden may be more than twice the weight of the rescuer. To illustrate his method, Mr. Cullinan, who weighs 140 pounds, placed two men on the ground, the first on his stomach and the other in the same position on top of him, with arms extended forward over and beyond the shoulders of the first man. Taking a position at the head of the two men, Mr. Cullinan raised their heads and bodies to an angle of about 45 degrees, then loosening his hold he ducked under them as the bodies fell, and caught them on his back. Then securing a lock hold at the knee and arms, he rose with the two men on his back, and in that position was able to carry them a considerable distance. The combined weight of the two men carried was 335 pounds. The method has been named the "Nevada one-man carry" and is a distinct innovation in mine rescue work.

Preceding the program of sports the electrical section of the Nevada Industrial Safety Association gathered in the Mackay School of Mines Building, where several interesting papers were read. These included one by E. P. Cullinan, chief electrician of the Tonopah Belmont mine, describing an electrolytic hoist control. Prof. J. G. Scrugham, of the engineering department of the university, read a paper prepared by himself and A. N. Voss, chief engineer of the Beowawe Locomobile plant, describing that plant. A. G. Jones, of the General Electric Company, read a paper on the use of nitrogen lamps and headlights; and E. M. Cutting, manager of the Edison storage battery department, read a paper on storage batteries.



INDUSTRIAL



NOVEL HYDRO-PNEUMATIC EQUIPMENT.

A novel hydro-pneumatic installation has recently been made by the Snowstorm Mining Company operating in the Coeur d'Alene district, Idaho. The plant consists of a 300 h.p. air compressor, rope driven by a Pelton water wheel and an induction motor direct coupled and working either independently or in parallel with the water wheel unit, when the latter rotates at 347 r.p.m.

Due to the variable water supply available for the wheel and the continuous operation required of the compressor, it was necessary to install a 250 h.p. electric motor to help out during the period that the water wheel was unable, from lack of water, to drive the compressor at the required load and speed.

Current for the motor is secured from a transmission line of a commercial plant supplying the district. Mounted on the electric motor shaft is a 46 in. dia. rope sheave which drives a fourteen foot sheave on the compressor. The compressor sheave is grooved for 19-1/4 in. dia. Manila ropes, and the sheave is cast with sufficient weight to permit obtaining the requisite flywheel effect for the compressor's operation. The American system of rope transmission is employed, the tension sheaves and re-winders being placed above the driving ropes and located in such a manner as to conserve floor space and head room to the greatest extent.

The water wheel equipment consists of a twin runner Pelton-Doble tangential water wheel unit, one runner being approximately 44 in. in diameter, and is capable of developing 325 h.p. when running at a speed of 347 r.p.m. This speed also coincides with the full load speed of the induction motor. The other wheel is approximately 72 in. in diameter and develops 250 h.p. at a speed of 212 r.p.m. Both water wheels are keyed on the same shaft, which is extended and coupled to the electric motor shaft, carrying the driving sheave. One or the other wheel must develop the requisite power when running at its correct speed; in this event the idle wheel, the pressure water being shut off from same, simply rotates on the shaft without performing useful work other than providing additional flywheel effect for the installation. Both wheels never develop power at the same time.

The requirements of the plant call for the highest efficiency over a wide range of operating conditions, involving approximately a 300 per cent fluctuation of the power water supply, and a variation of the compressor speed, hence the power required for same, depending upon the demands on the air line. It is necessary, during certain times, that 300 h.p. be delivered to the compressor sheave when the latter rotates at 95 r.p.m.

If there is sufficient water available the 44 in. Pelton wheel develops this power without assistance from the electric motor. Should the water supply be insufficient, current is applied to the electric motor to supply the deficiency. At other times, and over a period of several hours' duration per day, the compressor output is reduced to an amount corresponding to 58 r.p.m. In this event the water for the 44 in. Pelton wheel is shut off and it rotates idly while the 72 in. Pelton wheel is allowed to develop the power without assistance from the motor. While either wheel may develop its full power when operating at its correct normal speed of 347 r.p.m. for the 44 in. wheel and 212 r.p.m. for the 72 in. wheel, quite a wide variation of speed below normal may be secured, hence a most flexible installation has been secured.

The novelty of this plant consists of the application of a variable speed, variable power tangential water wheel unit to a constant speed induction motor, driving a compressor. The

plotted efficiency curves of the water wheels are quite flat for a range of power between 220 and 300 h.p. for the 44 in. wheel when rotating at 347 r.p.m., and for the 72 in. wheel between 160 and 230 h.p. output at 212 r.p.m.

For slight reductions of speeds below normal the efficiency holds up remarkably well, as was predicted. These results are obtainable from the type of ellipsoidal water wheel buckets employed in conjunction with needle regulating nozzles. The latter discharge a perfectly circular, solid jet under variations corresponding to full load of the respective wheels, down to about ten per cent of the maximum load. The hydraulic surfaces of the water wheel buckets are ground and sharpened and the whole water wheel unit especially developed for this particular plant.

To safeguard the water wheels from rupture due to centrifugal force, they are designed to operate under emergency runaway conditions of double the normal speed without stressing the parts beyond their elastic limit. The hydraulic apparatus was designed and constructed in the San Francisco works of The Pelton Water Wheel Company.

A NEW BRYANT SWITCH.

The Bryant Electric Company of Bridgeport, Connecticut, has produced a new snap switch especially for electric ranges and other heating appliances.

Instead of increasing the number of coils or elements in operation by throwing them progressively into circuit, as has been the custom heretofore, this new switch gives greatest heat at first operation. In other words assuming the switch to be in the "off" position, the first twist of the knob throws into circuit all the elements it controls. The second position cuts the heat down to medium, the third to low and the fourth is the "off" position.

In this manner, the degrees of heat are provided in the order in which they are most frequently desired, and a much smaller switch can be used. A feature of this new switch is that the indicating dial, showing whether the switch is "off" or in positions 1, 2 or 3, is set at an angle of 45 degrees so as to be visible from any position in front of or above the switch. Switches are made in the 2 1/2 and 5 kw. sizes.

BOOK REVIEWS.

Electric Motors. By F. B. Crocker and Morton Arendt; 305 pp.; 6x9; cloth. Published by D. Van Nostrand Company, New York City and for sale by Technical Book Shop, San Francisco. Price, \$2.50.

The second edition of this standard text contain many additions and revisions which bring the treatment more fully in accord with present day practice. While intended primarily for the use of the student the text is well adapted for study by anyone interested in the operation of motors, as matters of purely theoretical interest have been eliminated.

Walker's Manual of California Securities and Directory of Directors; 1914 edition; 544 pp.; 6x9; compiled by H. D. Walker, 454 Montgomery street, San Francisco. For sale by the author, or by Technical Book Shop, Crossley Building, San Francisco. Price, \$4.00.

The sixth annual number of this standard reference work of California investment securities maintains the high standard set in previous issues. The text is made up of nine sections giving respectively the bonded indebtedness of the state and large cities; the banks, the financial statements of the general corporations (including the principal utilities), the sugar corporations, the oil corporations, San Francisco street railway franchises, stock and bond quotations and directory of directors.



NEWS NOTES



INCORPORATIONS.

ORANGE, CAL.—El Modena Domestic Water Company has been organized with H. M. Gray, W. F. Crist, Isaac McCollum, John King and Geo. Wood as directors. The company, which will distribute water at El Modena, is capitalized for \$10,000.

FAIRVIEW, MONT.—Articles of incorporation for the Jennison Light & Power Company have been filed with a capital stock of \$100,000. The purpose is to erect a power and electric light plant near here. Chas. W. Jennison, Wiliston, N. D.; Herman O. Frank and Wm. D. Miller, Minneapolis, and Warren J. Jennison, Fairview, are the incorporators.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed by the California Terminal Railway Company with a capital stock of \$200,000, the purpose of which is to build a railroad from San Francisco to Sacramento. The new company has been incorporated to take over the interests of the California Terminal Company. C. W. Conlisk is the principal stockholder and W. M. Rank and C. H. Lind are the other incorporators.

TRANSMISSION.

RIVERSIDE, CAL.—The common council has granted permission to the Pacific Electric Railway Company to construct a new transmission line from its substation at Main and First streets, to Colton avenue, the line to run parallel to and 100 feet south of the Southern Pacific tracks.

LOS ANGELES, CAL.—Despite the fact that Superior Judge Hewitt has sustained the demurrer of the city, without leave to amend, in Frank E. Hartigan's suit attacking validity of the \$6,500,000 power bonds, Mr. Hartigan it is understood will appeal. The appeal will again delay the sale of the power bonds.

JUNEAU, A. T.—Speel River Electric Chemical Company and Speel River Power Company, which have obtained a government grant for hydroelectric chemical and power plant on Speel River, 35 miles south of here, expect to start construction work within a few months. E. P. Kennedy, Hotel Washington, Seattle, is interested in the project.

LOS ANGELES, CAL.—The city council has adopted a policy regarding the development of power on Big Pine Creek. The resolution sets forth that development of power on Big Pine Creek is a necessary part of the city's plan for developing electrical energy, and it is the purpose of the city to install plants on the stream for such a purpose and connect same with transmission system now being constructed.

VISALIA, CAL.—At a meeting of the directors of the Mt. Whitney Power & Electric Company held a few days ago J. C. Hays was retired from the office of president. The directors present were Mr. Hays, S. Mitchell, C. E. Baker, Ben M. Maddox and P. M. Longan. Mr. Hays has been president of the company for the past seven years, during its greatest period of development and construction. The action taken by the directors is presumed to be a part of a reorganization plan which has been under way for several months past, since the advent here of P. M. Longan, representing the J. H. Hammond interests.

LOS ANGELES, CAL.—Action seeking to cancel the right of way of the Kern River Company over public lands in California has been instituted by the U. S. District Attorney's office at the request of the Attorney General of the United States. The defendant company is a subsidiary of the Pacific Light & Power Corporation. The complaint filed would affect property, chiefly canals, valued at several millions within the Sequoia national forest. It is based on the alleged fact that the right of way grant given by the interior department was approved upon a showing that it was wanted for

public use, while in fact the corporation was already under contract to use practically all of the water for power generation.

FALL RIVER MILLS, CAL.—Fifteen miles of wire, also a great quantity of insulators, have arrived from Bartle, consigned to the California Power & Manufacturing Company. The shipment of materials is sufficient to complete the work of running the electric line from Fall River Mills to McArthur, $4\frac{1}{2}$ miles distant. Poles are set from here to McArthur and from here to Glenburn, the latter being seven miles distant, and the company intends to complete the service to McArthur, and be all in readiness to serve electric power, at least for lighting, to that place by October 1st. The company, whose headquarters are in San Francisco, purchased the electric light plant owned by Florin Bros. in Fall River Mills, in the early part of the summer, but has experienced many drawbacks in the construction work. It is not likely that the whole valley will be served with electricity for all purposes this season, as first seemed possible. However, the farmers hope that the power will be available for irrigation next season, irrigation being the main object of the development.

TRANSPORTATION.

SAN FRANCISCO, CAL.—The supervisors are in receipt of a communication from City Treasurer McDougald stating that he has disposed of \$150,000 worth of Geary street road bonds at 5 per cent to Bond & Goodwin. The premium amounts to \$950.89 and the accruing interest to \$1916.57, making a total of \$15,286.56.

FRESNO, CAL.—The Fresno Interurban Railroad is planning an extension of a mile and a quarter to a point within 400 feet of the Normal School. J. B. Rogers, who is promoting the building of these lines, has made application to the supervisors for a franchise extending from Fresno avenue to the Normal School. Rights of way are now being secured and a portion of the bonus desired has been subscribed. The new line will represent an increased capitalization of about \$20,000.

SEATTLE, WASH.—The City Council has agreed with receivers of the Seattle, Renton & Southern Railway to buy the road for \$1,600,000, transfer to be made October 1st. The line will be made part of the municipal system already in operation. The Seattle, Renton & Southern Railroad is 12 miles long and extends from the business center of Seattle to the coal mining and manufacturing town of Renton. The purchase of the line would permit the city to connect the northern and southern divisions of its municipal system, which do not now reach the business district. The Renton line has been in litigation for many years. A court decision last month affirmed the validity of its franchise, which the city officials had questioned.

SAN FRANCISCO, CAL.—The supervisors heard various plans for constructing the Municipal Railway on Church street, between Eighteenth and Twenty-second, at a recent meeting. City Engineer O'Shaughnessy maintains that the scheme he first submitted and now known as plan No. 4 is the best. As this plan involved the assessment of property owners in the adjacent district to the extent of \$330,000 for opening a new street, protests were filed by them, and for that reason the supervisors last April called for other plans. The city engineer says that the Church street road is to be a main-trunk line of the Municipal Railway. Its terminus at the beginning will be at Thirtieth street, but the intention is to extend it to the Sunnyside district and eventually to the county line. As it will be a main line, it should have no dangerous grades, O'Shaughnessy says, that the

best way to secure proper grades is by cutting a new street along Mission Park from Eighteenth to Twentieth street and through private property from Twentieth to Twenty-second.

SAN FRANCISCO, CAL.—City Engineer O'Shaughnessy states that the construction of the Municipal Railway line on California street will soon be commenced. This road will begin at Geary street and Second avenue, where a connection will be made with the Geary street line, and will run along Second avenue, Cornwall street to Sixth avenue, and California street to Thirty-third avenue. The City Engineer says that the specifications will be ready in two weeks and that the contract can be awarded about the beginning of October, in which month he expects work to begin. He counts on having this line in operation before the end of this year. The Board of Works has agreed to pay the United Railroads \$1400 for reconstructing the crossing at Sixth avenue and Cornwall street and installing a crossover for the Municipal Railway. The United Railroads has offered to sell to the city its track and roadbed on California street, between Ninth and Twelfth avenues, for a reasonable price, and the city engineer has the proposition under consideration. The terminus of the California street line will be at Thirty-third avenue for the present, but city officials say that after the road is in operation an arrangement may be made with the United Railroads for running city cars further out over the United Railroads' tracks.

ILLUMINATION.

WHITEFISH, MONT.—Call for bids for the construction of an electric light system here will be issued by the town clerk.

ANDERSON, CAL.—By a vote of 123 to 10 this place has voted to establish a lighting district that is co-extensive with the town.

FLAVEL, ORE.—Request will probably be presented to the Pacific Power & Light Company, Astoria, to furnish lights for this town.

NEWPORT, CAL.—An ordinance has been adopted providing for the issuance and sale of bonds in the sum of \$20,000 for the construction of an electric street lighting system.

HOQUIAM, WASH.—L. H. Burnett and associates of Aberdeen, who are incorporating a company to bore for natural gas, have made application for a 50-year gas franchise in this city.

REDLANDS, CAL.—The Edison Electric Company has submitted bids for street lighting and park lighting, the present contract expiring in December. Bids were referred to the street lighting committee.

PLUMMER, IDAHO.—Dunkit Brothers have been granted a certificate of public convenience and necessity by the public service commission of Boise, for the installation of an electric generating plant here.

SACRAMENTO, CAL.—The Westinghouse Electric Company has been granted a contract by the State Board of Control to furnish the state buildings with electric lamps for the ensuing year. The contract amounts to about \$10,000.

LOS ANGELES, CAL.—The city electrician has submitted to the board of public works specifications for the proposed ornamental lighting system for Mariposa avenue, between Romaine and Melrose avenue. Actual work will begin shortly.

BERKELEY, CAL.—A resolution of intention has been adopted for lighting with gasoliers the entire length of San Pablo avenue. The plans call in all for 65 lamps and the Pacific Gas & Electric Company will begin their installation at once.

HERNOSA BEACH, CAL.—A petition signed by property owners has been forwarded to the board of county supervisors, requesting that they sanction the establishment of a

highway lighting district beginning at Manhattan Beach city limits and extending to the city limits of Hermosa Beach, a distance of nearly two miles.

BANNING, CAL.—C. H. L. Ghreist & Son, who will install an electrical distributing system here, announces that work will be commenced immediately. The same company has been granted a franchise in Mojave also, and will install a plant there.

CATHLAMET, WASH.—The council has taken preliminary steps for the installation of a municipal lighting plant. Power is to be furnished by a distillate engine, but waters of Elocaman River, 10 miles distant will be utilized later. The estimated cost of the initial unit is \$4200.

LOS ANGELES, CAL.—The contract for improvement work in the Lankershim Lighting District has been awarded to the Newberry-Bendheim Electric Company. Returns from elections for the formation of Newhall and Lancaster Lighting District were canvassed and resolutions adopted forming the districts.

BOISE, IDAHO.—The council will cancel the contract with the Idaho-Oregon Light & Power Company for installing lamps and furnishing power for lighting the streets of South Boise and the city will install its own system and attach to the rectifiers which have been installed for use for the Central street system.

TELEPHONE AND TELEGRAPH.

VENTURA, CAL.—The Pacific Telephone & Telegraph Company will in the immediate future expend \$15,890 on replacing poles between Ventura and Carpinteria.

BLYTHER, CAL.—The franchise applied for by Floyd Brown for the operation of a telephone and telegraph system here for a period of 50 years, will be sold to the highest bidder on September 21st.

LOS ANGELES, CAL.—The Whittier Home Telephone & Telegraph Company has been granted a franchise to erect a telephone and telegraph system upon certain public highways in Los Angeles county.

LEWISTON, IDAHO.—Approximately 13,800 will be expended here on exchange of poles, aerial wire, aerial and underground cable construction, repairs, etc., by the Pacific Telephone & Telegraph Company.

ASTORIA, ORE.—Astoria is to have a wireless telegraph station to be erected by the Marconi Wireless Telegraph Company on the tract recently purchased at the Hess place. Work on the construction will commence immediately.

SAN FRANCISCO, CAL.—The Marconi Wireless Company's new receiving and sending station near Honolulu is about completed. The stations at Bolinas and Marshall bays, in Marin county, are also completed, and the messages will begin to flash between Hawaii and this coast September 20th.

SAN FRANCISCO, CAL.—In order to preserve strictly the neutrality laws Admiral Chas. F. Pond, commander of the 12th naval station, has taken added precautions to insure the sealing of all wireless apparatus on ships belonging to any of the belligerent nations. Pond's order calls for a weekly inspection of all merchant vessels whose wireless has been sealed. The first step in this direction was taken with the arrival last week of the Chiyo Maru. Hereafter the U. S. S. Raleigh will keep a close watch on merchant vessels, an officer from the American cruiser being detailed to inspect all the ships of the warring nations each Monday. Upon the arrival of ships, a commissioned officer will be detailed to board them and seal the wireless by force, if necessary. The ship's master will be notified that the wireless seal must not be broken until permission is given and after he has cleared and reached the high seas. Inspectors of wireless outfits will make written reports to the supervisor of the district.

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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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VOL. XXXIII No. 13

SAN FRANCISCO, SEPTEMBER 26, 1914

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SAN DIEGO ELECTRIC RAILWAY EXTENSIONS.

BY K. G. DUNN.

CONSTITUTIONALITY OF THE 1913 NEVADA
IRRIGATION ACT.

BY A. E. CHANDLER.

THE BUCKHORN LOCOMOBILE POWER PLANT.

BY A. N. VOSS AND J. G. SCRUGHAM.

STANDARDS AT SAN DIEGO.

BY M. L. KLAUBER.

PUBLIC POLICY.

BY F. T. POST.

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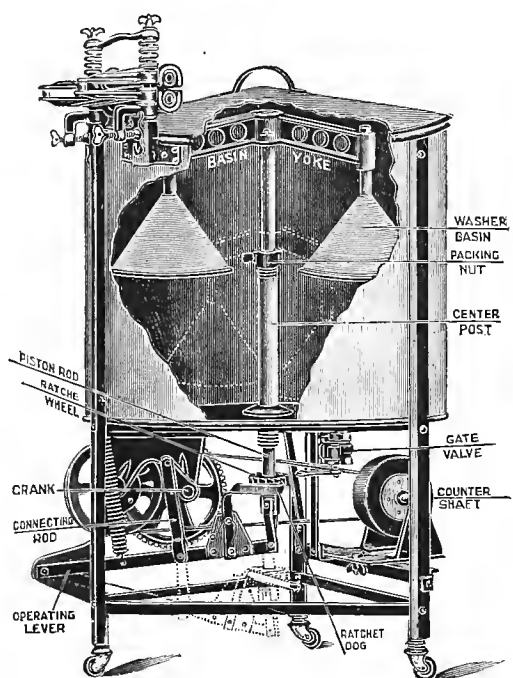
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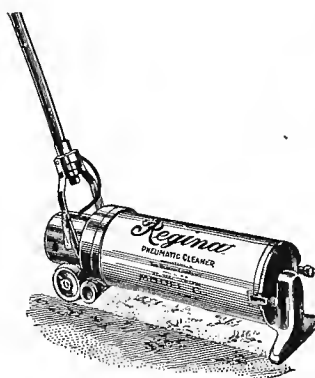
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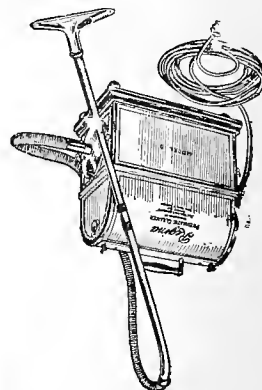
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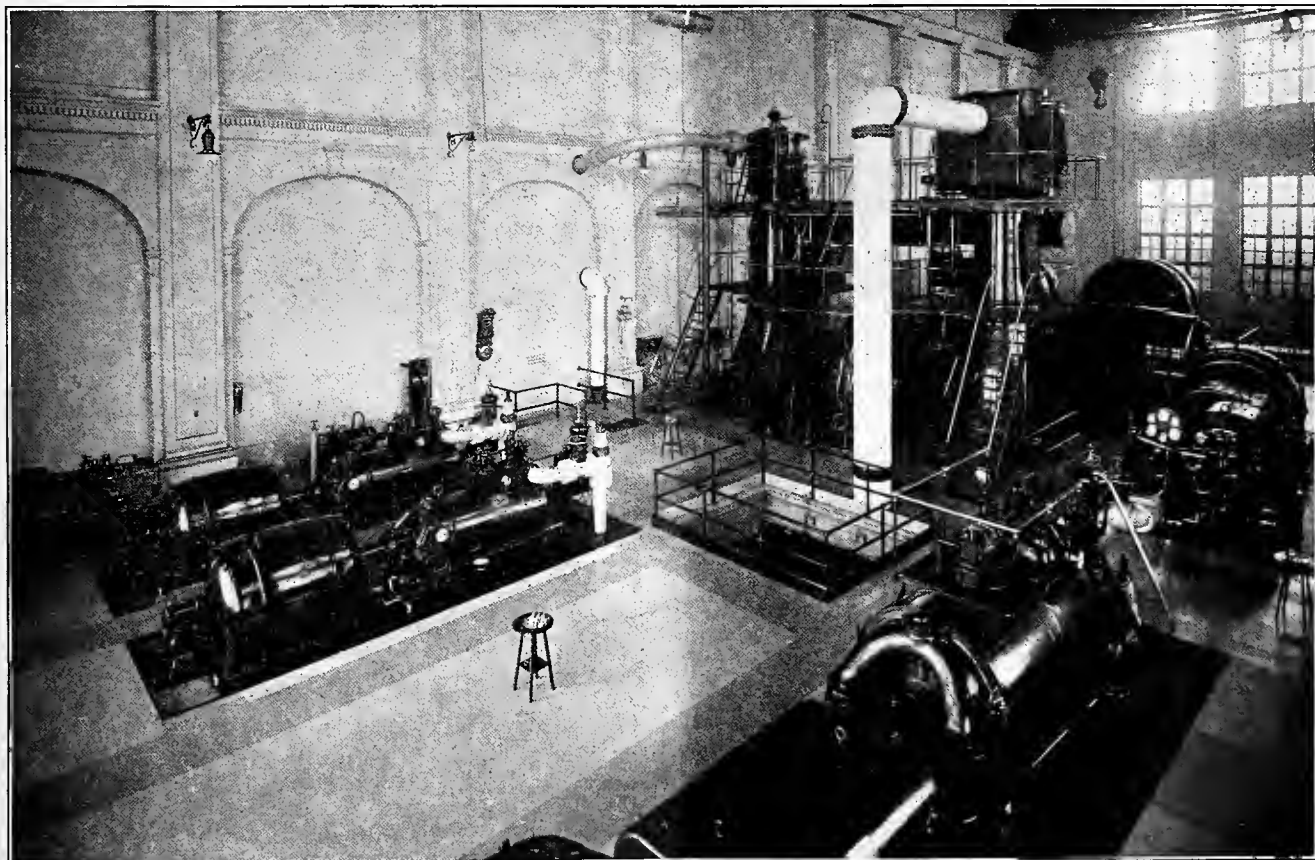
SAN DIEGO ELECTRIC RAILWAY EXTENSIONS

BY K. G. DUNN.

(This article comprises a description of equipment recently installed to meet the growing traffic needs of San Diego and the Panama-California Exposition. Particular interest attaches to the control equipment employed and to the operation of a compound condensing steam engine in connection with an exhaust turbine and reduction gear.—The Editor.)

The city of San Diego has enjoyed a remarkable growth in the past few years and its citizens are optimistic regarding the future growth of their city, and justly so, as San Diego will be the first American port of call north of the Panama Canal. The increased

built on this line at the eastern entrance to the Exposition grounds. The largest percentage of the Exposition traffic will be handled by this line. This double track line through the park is not of a temporary nature, exclusively for the Exposition, but it is to remain



General View of Generating Equipment in San Diego Electric Railway Company's Plant.

volume of business, due to the Canal trade, the influx of visitors that will have to be cared for during the Exposition period, together with the steady normal increase of this thriving city has made it necessary for the San Diego Electric Railway Company to make extensive additions to their present power house and rolling stock.

A new double track line is being constructed through Balboa Park and a terminal station will be

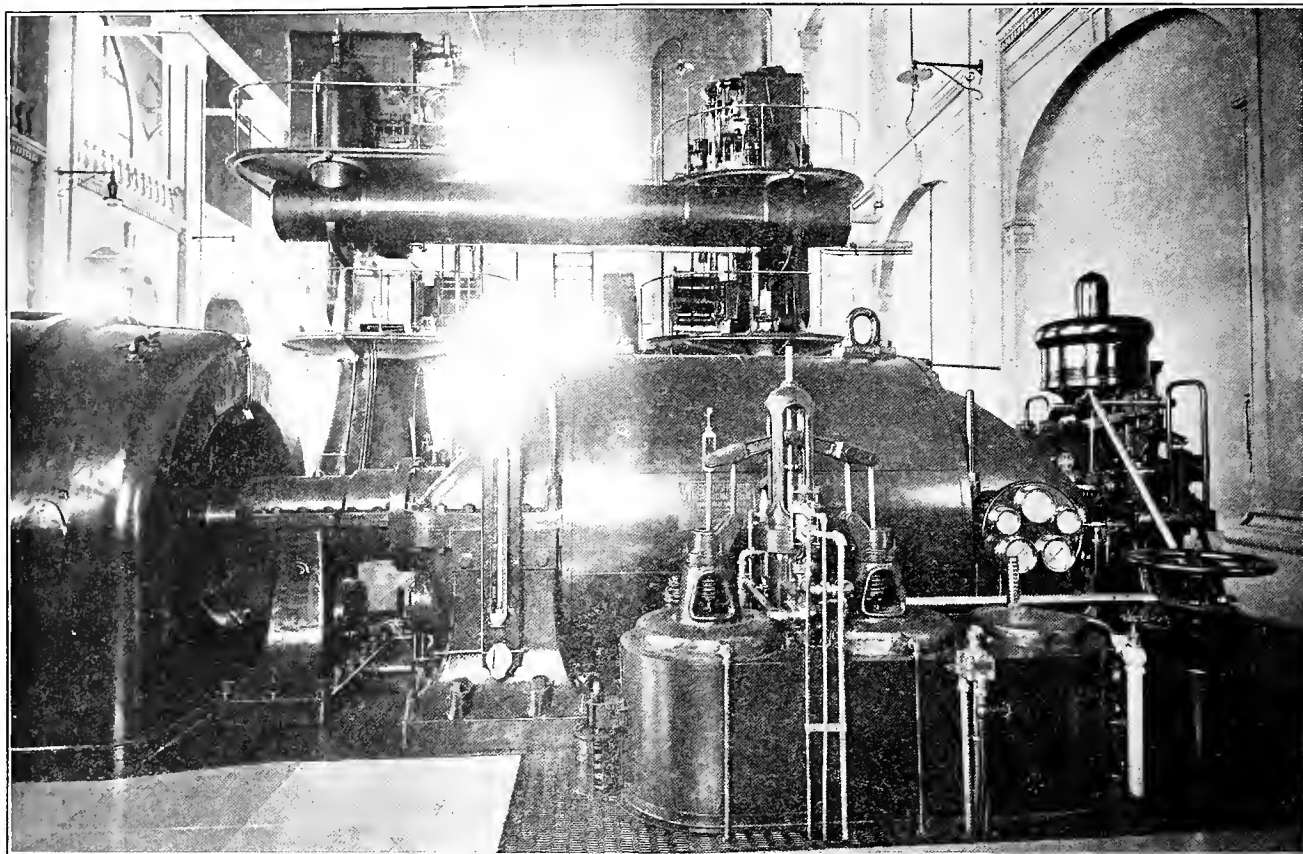
as a permanent improvement as the line continues north of the Exposition terminal and connects with the present trackage on University avenue. This line will virtually give an express service to points north of the Park and East San Diego and will result in a reduction of ten minutes in the running time.

Extensive improvements are now being made in the down town district in order that the Exposition service to the main entrance can be operated over a

loop and avoid the turning of cars. All new track that is laid in paved streets consists of 114 lb. 7 in. girder rails laid in the most approved manner.

All of the recent rolling stock purchased by the San Diego Electric Railway Company is of the most modern type, center entrance cars having an open and closed section. These cars have proven especially

are liberally proportioned and are capable of operation at 50 per cent overload for two hours. Each set has a direct connected exciter and provision has been made for separate excitation from an auxiliary bus in the event of failure of the direct connected exciters. These sets are also equipped with magnetic oscillators and speed limit trip devices, which operate a shunt trip on



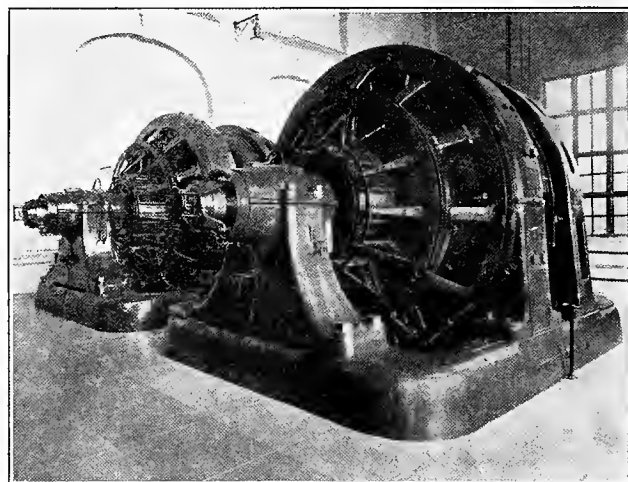
Low Pressure Turbine Unit.

adapted to the climatic conditions existing in San Diego. The cars are of the pay-as-you-enter type and are equipped with multiple unit control in order to allow of train operation during periods of congested traffic. The cars were designed by Homer McNutt, superintendent motive power, San Diego Electric Railway Company, and many novel features are embodied in their construction.

The addition to the power plant equipment consists of a 5000 kw. Westinghouse-Parsons steam turbine unit with direct connected exciter, together with motor generator sets and switchboard. The unit is served by a 13,000 sq. ft. surface condenser with steam driven auxiliaries. The circulating water supply to the station is furnished through a 54 in. concrete gravity intake line and a discharge line of like capacity. These conduits terminate in a chamber arranged with gates so that the circulation in the conduits can be reversed and alternately used for suction or discharge purposes. Circulating water to all condensers in the plant is furnished through a common header system. The discharge from all condensers is operated on the syphon system.

Two 1500 kw. General Electric synchronous motor generator sets have been installed and foundations and conduits for the third set are now in place. These sets

the positive breaker. The exciter speed limit and oscillator wiring are carried up through the bedplate and pedestals, making a neat arrangement. The motors



Synchronous Motor Generator Sets.

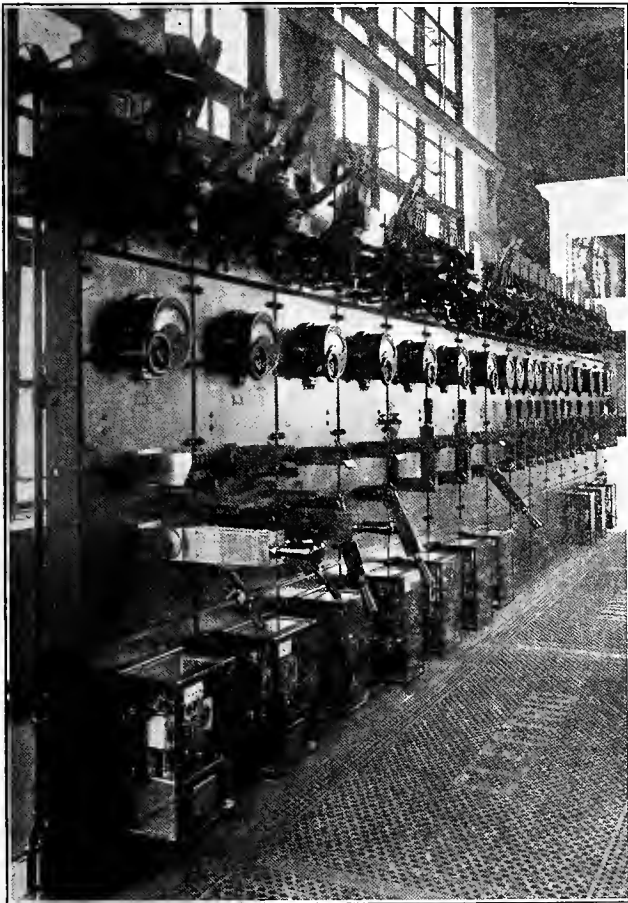
are of the self starting synchronous type; two large capacity compensators have been installed and so arranged that either compensator can be used for starting any motor generator set.

The negative and equalizer busses are installed in the basement and carried on brackets immediately underneath the machines. Each bus consists of several leaves of $\frac{1}{4} \times 5$ in. copper bus and bus copper connections are between these busses and the negative and equalizer machine terminals.

The alternating current switchboard is electrically operated with the exception of the main exciter switches. The panels are 16 in. wide and all meters are of the 7 in. type. The field switches to the main generator and motor generator sets are electrically operated, there being two switches for each field, one

in the concrete structure. The oil switches with their operating mechanism and the bus are placed on one side of the cell structure while the disconnecting switches, series transformers and potential transformers are on the opposite side of the cell structure. Small panels for integrating wattmeters have been installed on the wall of the building opposite the disconnecting switches. Cells for future switches, together with control and main lead conduits have been provided.

The control for the starting switches to the motor generator sets operate both the starting and magnetiz-



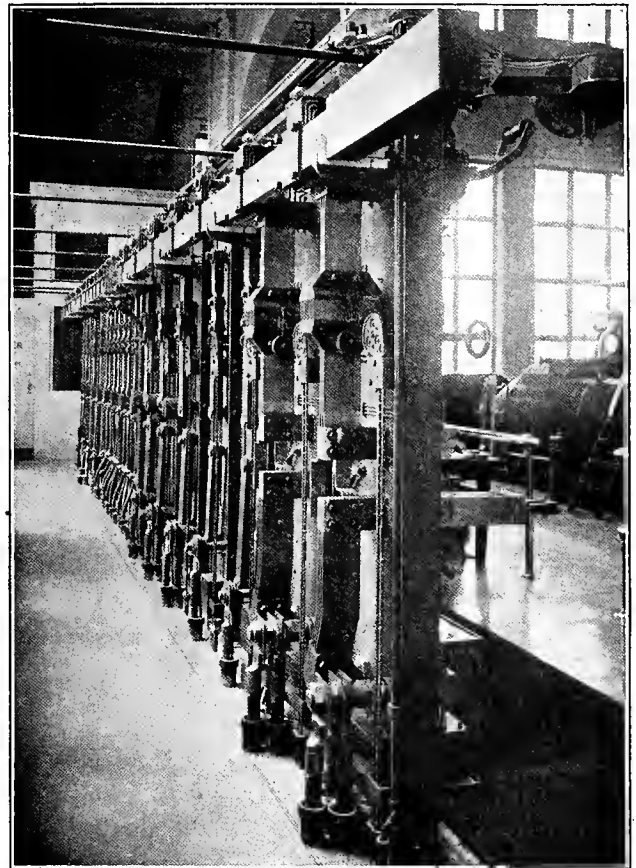
Front View of A.C. Switchboard.

controlling current from the direct connected exciter and the other controlling current from the auxiliary bus.

The electrically operated field switches are mounted on the foundation wall of each particular unit, which makes the shortest possible wiring arrangement. It should be noted in connection with the self starting synchronous motors that this arrangement eliminates the possibility of an operator coming in contact with the exposed field switch terminals which are subjected to a high induced voltage at the moment of starting.

A single a.c. bus is installed at present, but provision is made on the board for an auxiliary a.c. bus. The handles, face plates and lenses for signal lights have been installed for the future a.c. bus as shown by the front and rear views of the board.

All oil switches are placed in a concrete cell structure situated on a balcony above the control board. All instrument wiring is carried in conduit imbedded



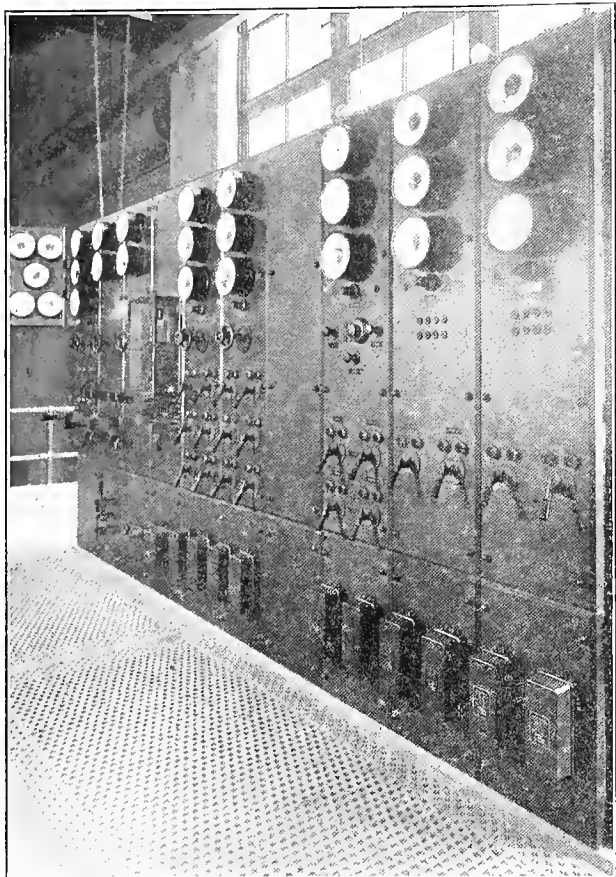
Rear View of A.C. Switchboard.

ing switches so that there is no possibility of an operator neglecting to open the magnetizing switch to the compensators. The switches are electrically interlocked so that the running switch cannot be closed when either or both of the magnetizing and starting switches are closed and vice versa. One of the panels controls two exchange circuits between the plants of the San Diego Consolidated Gas & Electric Company and the San Diego Electric Railway Company, another panel supplies current through a submarine cable to the City of Coronado and the last panel controls a tie line between the new board and an old board which controls two small a.c. turbines and two induction motor generator sets.

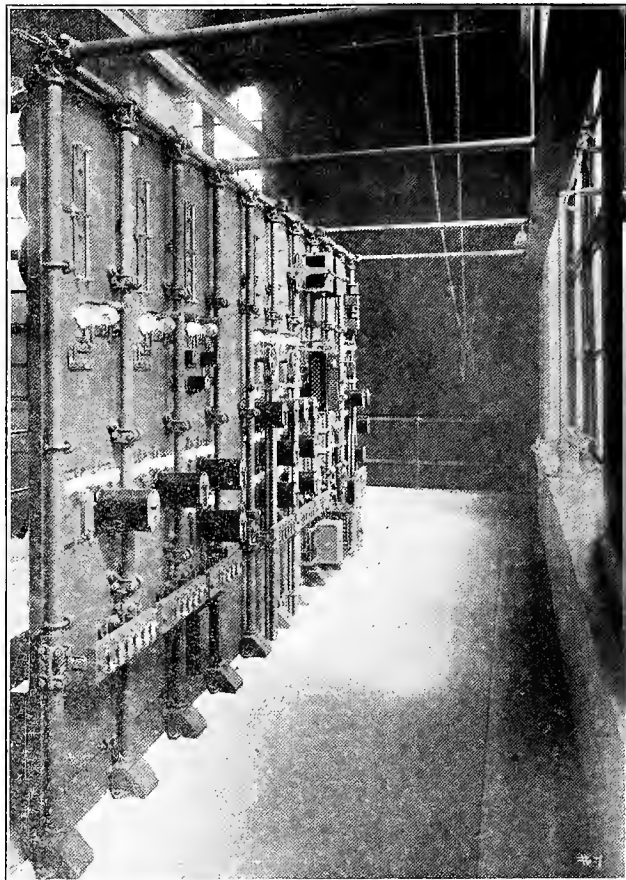
From an inspection of the rear view of the board, it will be noted that a large amount of control wiring is carried up through the pipe columns. Special junction boxes are installed at the foot of the columns, this arrangement protecting the control wiring from mechanical injury and presenting a neat appearance on the back of the board.

The board at the present time controls seven generators, eight city feeders, three interurban feeders and the auxiliary apparatus for the station. As previously stated, the negative and equalizer busses are

Chalmers unit, direct connected to a 1200 kw. Westinghouse 600 volt generator. The exhaust from this engine is delivered to a 1000 kw. Westinghouse-Parsons exhaust turbine operating at 3600 r.p.m., and



Front View of D.C. Switchboard.



Rear View of D.C. Switchboard.

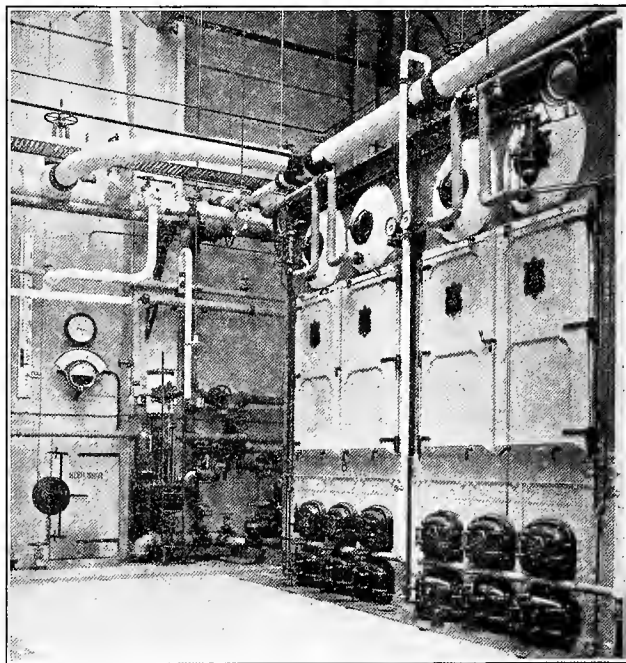
in the basement and only the positive leads of the apparatus are carried to the board, except the necessary negative connection for voltmeter plugs and wattmeters. The feeders pass directly from the board to potheads placed immediately below the board in the basement and lead covered cables are installed in vitrified clay conduits to points beyond the underground district where they connect with the overhead distributing system.

The boilers are placed at right angles to the engine room. A totalizing ammeter on the division wall between the engine room and boiler rooms, in plain view of the firemen, indicates the total direct current output of the station and gives a visual indication to the firemen of the exact load on the plant. This instrument has been in service for several months and the firemen depend absolutely on its indication. It is interesting to note that since its installation there is a marked improvement in the regulation of steam pressure, as shown by recording pressure gauge charts.

A master steam gauge is mounted on the face of the Weston indicating ammeter.

All boilers are equipped with General Electric steam flow meters, which are just as essential as ammeters on the direct current generators. The boilers are of the Babcock & Wilcox type and are regularly operated over swings and peak loads in excess of 200 per cent of the builder's rating.

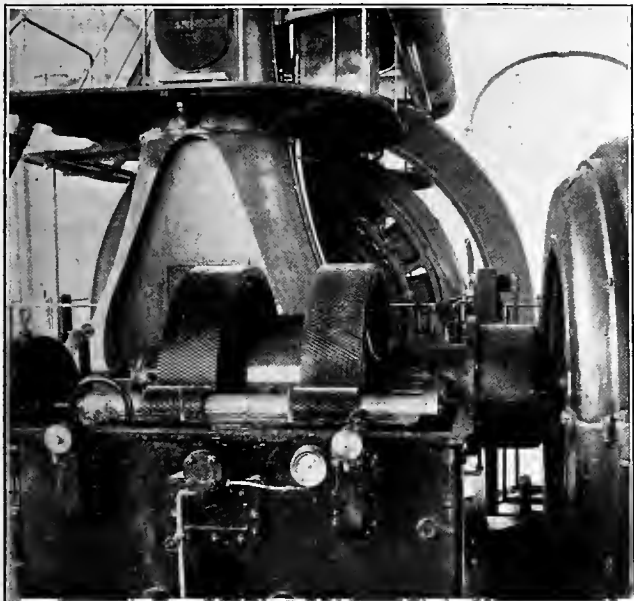
The engine is a vertical cross-compound Allis-



Portion of Boiler Room, Showing Totalizing Ammeter.

is direct connected to a gear having a 7 to 1 reduction, driving a 1000 kw. Westinghouse 600 volt direct current generator at 514 r.p.m. This combination unit is of particular interest as it is a case of a high duty compound condensing engine being operated in connection with an exhaust turbine and reduction gear.

The unit has been in operation three years, the actual hours operation showing more than two years' continuous twenty-four hour service. The gear is of the Westinghouse floating frame type and at the present there is practically no wear. From all indications its life should be as long as that of either the turbine or generator. The turbine is of the variable inlet pressure type. During times of lighter load there is from 10 to 15 inches vacuum in the low pressure



Turbo Generator Gear.

cylinder, while at periods of heavy load, the low pressure cylinder is exhausting against 1 lb. gauge back pressure. Under present load conditions, the engine and exhaust turbine carry the load during the off peak period and other units are operated during the morning and evening peaks.

The station furnishes current to the railway exclusively and operates twenty hours per day. Under the present load conditions the station is delivering 180 kw. hours of direct current to the bus bars per bbl. of fuel oil. Hunt, Mirk & Co., Inc., installed all apparatus.

The economy of converting horse-drawn fire apparatus to motor operation is shown by some figures compiled for a former horse-drawn fire engine, which was equipped for battery drive by the New York fire department. The front wheels of the vehicle were replaced by couple - gear motor-driven wheels operated from a storage battery. The conversion cost \$4000, but the reduced expense at which the vehicle has since operated apparently justified the change. Renewals and repairs for two years subsequent to the change cost \$744.39. Of this amount \$486.97 was spent in renewing the battery after the vehicle had been in service one year. Adding to the above maintenance expense, the depreciation and battery charging costs, the total operating expenses for the two years amounted to \$1370.03, as compared with an average of \$1469.06 for horse-drawn fire engines answering about the same number of calls.

CONSTITUTIONALITY OF THE 1913 NEVADA IRRIGATION ACT.

BY A. E. CHANDLER.

The office of the state engineer of Nevada was created in 1903. The irrigation act of that year provided for the determination of water rights upon streams by the state engineer. The act was founded upon the irrigation acts of Wyoming and Nebraska.

The Nevada act has been amended a number of times since 1903 and in 1913 was so amended as to include more details of procedure leading up to the determination—following very closely the Wyoming act.

At the time of the passage of the 1913 amendment the state engineer of Nevada was engaged in determining the water rights along the Humboldt River. He continued doing so after the adoption of the 1913 amendment, but made his practice conform to the provisions thereof. Certain farmers of the Lovelock Valley, the lowermost valley along the Humboldt River, attacked the constitutionality of the act and the Supreme Court of Nevada, under date of August 4, 1914, handed down its opinion—the name of the case being *Anderson v. Kearney*.

Mr. Justice Norcross, who wrote the opinion for the court, after briefly summarizing the provisions of the act of 1913, shows that the real aim of the act is to vest in the state engineer the distribution of water among those entitled to its use. The following quotation shows his realization of the need of vesting such control in a central body:

It is difficult to perceive how there may be any effective regulation or control over the water rights of a stream system like that of the Humboldt River and its tributaries, except through some form of state supervision. This river extends for a distance of about three hundred miles, is in five counties and three judicial districts. According to the brief of counsel for respondents in case No. 2115 there are from 800 to 1000 water users on the Humboldt River system. Undoubtedly other claimants are constantly applying for water rights on this system. The state at large is not only interested in protecting prior appropriators in their rights, but is interested in the conservation of the waters of the stream system to the end that the largest possible amount of land may be brought under cultivation through an economical diversion and use of such waters. To accomplish this beneficial object, the state has a right to exercise a superintending control over the entire river system. It is not to be assumed that so great and so important an undertaking cannot be fairly and intelligently administered. If so administered it would seem that it ought to be particularly advantageous to prior appropriators. It is the history of irrigation in this and other states that the first appropriators of waters upon the natural streams are frequently forced into long, vexatious and expensive litigation to protect their rights against subsequent appropriators. The case of *Bliss vs. Grayson* and *Anderson* in the state courts, involving water rights on the Humboldt River and *Miller & Lux vs. Rickey et al.*, in the Federal Court, involving water rights on the Walker River, are conspicuous examples showing the need of some kind of intelligent state intervention. The case of *Bliss v. Grayson* begun in the District Court of Humboldt County in July, 1889, reached the Supreme Court a decade later, with the result of a reversal and a new trial ordered. (*Bliss vs. Grayson*, 24 Nev. 422.)

According to Mr. Justice Norcross the real question before the court was as to the right and authority of the state engineer to make determinations of water

rights—it being argued that such action was clearly judicial, and, therefore, beyond the power of an administrative officer like the state engineer.

After a careful consideration of opinions by the Supreme Courts of Wyoming, Nebraska and Idaho dealing with cases wherein it was claimed that the state engineer was exercising powers exclusively judicial, Mr. Justice Norcross holds that the action by the state engineer is clearly administrative and not judicial. He further states that it is unnecessary at this time to consider other constitutional questions raised in the case, especially in regard to the finality of the state engineer's determinations.

The opinion shows that Mr. Justice Norcross fully appreciates the effectiveness and necessity of a determination of water rights in a manner different from the ordinary court procedure, and that he seeks substance rather than form.

Mr. Chief Justice Talbot concurs with Mr. Justice Norcross in so far as he believes the determinations by the state engineer to be administrative. He states, however, that the section of the act making the determination by the state engineer final, unless appealed from, is unconstitutional. He raises a further question as to the right of the state engineer to distribute the water of the stream in accordance with his determinations, as is shown by the two final paragraphs of his concurring opinion quoted below:

It being concluded that the state engineer may take evidence and determine water rights for administrative purposes, and that his determinations are not binding as final adjudications, even if no appeal from them be taken, the further question arises as to whether, on the same theory that banks, railroads and public service corporations are controlled, the state engineer, with the assistance of the duly appointed water commissioner, may allow, restrict and regulate the use of the water claimed under vested rights without impairing them, in accordance with his determinations subject to the right of any water-user who may feel aggrieved thereby to apply to the courts to restrain the state engineer or the water commissioner from depriving the appropriator of any water to which he may be entitled.

If the parties or any of them desire to have this question determined, it may be suggested that counsel present their views regarding the same in a petition for a rehearing or answer thereto. The case is of unusual importance, and if this question is to be determined it should be given due consideration.

Mr. Justice McCarran, in a long dissenting opinion, holds that the sections of the act in question are clearly unconstitutional and that the state engineer has on right or authority to determine water rights.

The fact that each of the three Justices of the Supreme Courts wrote a separate opinion shows the importance of the question before them. The only point really decided is that the state engineer as an administrative officer may proceed under the provision of the act to determine for administrative purposes the water rights along a stream. Two Justices, however, declare that such determinations cannot be considered final even if not appealed from—the act making full provision for appeal to the courts in all cases where parties are aggrieved by an order of the state engineer.

There is little question among students of water right conditions as to the most expeditious way of determining water rights. There is much question, however, among lawyers as to how far administrative officers may go in this determination. The trouble lies in the technical interpretation of the constitutional provisions dealing with the division into the three departments—legislative, administrative and judicial—and with procedure in the last department.

It is a practical question as to whether a determination by the state engineer is of any use without a provision for making it final. It is claimed by a number conversant with the subject that the mere fact that the question has been so carefully investigated by the state engineer will make water users satisfied with the determinations without further resort to the courts.

As stated in Mr. Justice Norcross' opinion, the real purpose of recent irrigation acts is to secure the distribution of water among those entitled to its use. Before this can be done the water rights must be determined. Unless such determination is final there is bound to be trouble during seasons of drought when water commissioners must close the headgates of the ditches having the latter priorities. A case is now in the courts wherein certain water users in Muddy River Valley in southeastern Nevada are attempting to enjoin the water commissioner and state engineer from interfering with their headgate, and such cases will constantly arise unless the determination is made final.

In view of the doubt cast upon the efficiency of the 1913 Nevada irrigation act, the construction of the Oregon irrigation act becomes of the utmost importance. The latter act is very similar to the Nevada act, except it provides a method whereby a court passes upon the determination without waiting for an appeal by aggrieved parties. Cases involving the constitutionality of the Oregon act are now in the courts.

ELECTRICAL INDUSTRY AND THE WAR

The electrical industry has been hard hit by the war in Europe. General Electric, while it has no great foreign connections or branches, has been greatly affected by the war and earnings and shipments have fallen off sharply since August 1st. The company now has 9000 fewer men than one year ago. The 8 per cent dividend is understood to have been earned in the first 7 months of this year, but many of the corporations which buy its products have to do so with borrowed money, and hence a heavy falling off is expected because only the soundest corporations will be able to borrow and they will have to cut down their needs in this respect to a minimum. In view of this a cut in the dividend would not be considered a big surprise to those in close touch with conditions.

Western Electric's plants in Antwerp and Paris have been closed and 800 Edison Company employes have been laid off. The Westinghouse Company's foreign plants have curtailed or cut down and there has been a great deal of confusion as the result of the disruption of the relations between the American and foreign plants.

THE BUCKHORN LOCOMOBILE POWER PLANT.

BY A. N. VOSS AND J. G. SCRUGHAM.

(A description is here given of a locomobile steam-electric power plant which is giving an output of 1 kw. for 1.7 lb. of oil. Mr. Voss is chief engineer of the Buckhorn Mines Co. and Prof. Scrugham acted as consulting engineer. This was presented as a paper at a meeting of the Nevada Industrial Safety Association on Sept. 7, 1914.—The Editor.)

The power plant of the Buckhorn Mines Company at Beowawe, Nevada, consists of a unique installation as far as prime movers are concerned, there being installed two 290 h.p. units of the Wolf locomobile engines, made in Germany. The engines rest directly on the boiler shell, which is made of 1 in. boiler plate. The flue sheet is 1 in. thick, the flues being standard 3 in. flues of extra heavy material, and 94 in number. Seventeen of these flues serve as stay bolts, being threaded on both ends, and made of heavier material than the others. Directly behind the flues is the superheater, consisting of many turns of pipe made up into a coil. Steam is generated at 225 lb. pressure and superheated 210 degrees so that at present we have an average steam temperature of 600 degrees F. at the throttle.

The firing system, as originally installed, was the gravity feed, steam atomization, but this was found to be unsatisfactory and uneconomical, chiefly because of insufficient combustion space. To remedy this defect an extension furnace, 48 in. diameter and 36 in. long, was built and attached to the front of each boiler. This furnace extension is mounted on a truck to permit ready removal from the boiler. All bricking was removed from the interior of the furnace except an arch-supported wall 2 ft. from the flue sheet and a brick lining in the extension. This furnace rearrangement effected a saving of approximately 12½ per cent in the fuel costs.

A new system of firing was also installed. It now consists of a pump, heater, oil line, and burner arranged so that the oil pressure can be varied to suit requirements, oil kept at 250 degrees F. This oil is forced through a burner, normally at 120-140 lb. pressure, where it is broken up by a mechanical atomizer and discharged into the furnace. A regulating cone is placed about the burner tip, so that by adjusting this cone the amount of air necessary to obtain complete combustion can be accurately regulated. Under ordinary conditions little adjustment of oil pressure or cone is necessary.

The two cylinders of the locomobile are mounted side by side directly over the fire box, being respectively 12½ in. and 24½ in. diameter. The pistons are of the balanced type, having a stroke of 19¾ in. The packing for the stems is metallic.

The crank shaft is 8 in. diameter and turns at 225 r.p.m. A fly-wheel is overhung from each outside bearing.

The governor is a fly-wheel governor and is guaranteed to vary not more than 3 per cent above or below the predetermined speed and I will say that it takes advantage of its entire allowance.

The vacuum pump is connected to the engine by means of a belt device from a hub cast on the fly wheel. The plunger of the vacuum pump has an ex-

tended stem on the end of which is the plunger for the feed water pump. No matter what goes wrong, be it only packing blown out on pump stems, we are compelled to take one unit out of service until it is repaired.

The engines are directly connected to 175 kw. General Electric 3-phase, 60-cycle, 480 volt a.c. generators with 35 kw. belted exciters, each exciter large enough to excite both generators. Under ordinary conditions one of these exciters is motor driven, but is in such a position that the belt can be run from the pulley on the generator. A Tirrell regulator on the exciter field keeps the exciting current so as to maintain constant potential on the busses.

The switchboard is composed of three panels of blue Vermont marble, one for each generator and one for the main line. On each generator panel we have an a.c. ammeter, d.c. field ammeter, and a.c. indicating wattmeter, and on the main line panel we have an a.c. ammeter with 3 way switch, power factor indicator, graphic recording wattmeter, integrating watt hour meter, and graphic recording voltmeter. On a swinging panel at the right of the switchboard is a synchroscope, bus voltmeter, generator voltmeter and frequency indicator. The d.c. exciter voltmeter is mounted over the switchboard.

Three 175 kw. General Electric transformers step up the voltage from 480 to 30,000 for transmission to Buckhorn, 30 miles away.

The line is 3 No. 4 B. & S. gauge solid copper spaced on the corners of a 5 ft. triangle. Wooden pole construction is used throughout. Thirty-five foot 7 in. top poles are set 250 ft. apart and 5 ft. deep. The crossarm is wood and pole top pin is wood; the pins in the crossarm have porcelain base. The insulators are No. 311 Locke. The phone line runs on brackets 5 feet below the crossarm, No. 44 Locke insulators and No. 12 B. & W. iron wire being used. The line is transposed every 10 spans.

General Electric electrolytic lightning arresters are installed on both ends of the line. We have had very severe storms during the past four months and have had no trouble anywhere except that due to our own fault.

At Buckhorn 3 General Electric 175 kw. transformers step down the potential from 30,000 to 480 for motor use, and one 20 kw. transforms from 30,000 to 220/110 for lighting.

The most interesting feature of the performance of the unit is the high fuel economy.

The record sheet shows an average fuel consumption of 1200 bbl. of 13.2 gravity oil per month, producing approximately 240,000 kw. hours at the switchboard, or 200 kw. hours per bbl. of oil weighing 240 lbs., equivalent to 1.7 lbs. of oil consumed per kw. hour net output. As the engines are only loaded to 80 per cent of capacity, it is probable that this performance can be excelled with full load conditions. The mechanical efficiency of the unit is about 92 per cent as obtained from the ratio of indicated to brake horsepower.

More detailed figures on the performance will shortly be available as it is planned to conduct a complete mechanical test at an early date.

ELECTROLYTIC HOIST CONTROL.

BY E. P. CULLINAN.

(This interesting description of a method of flexible control of electric mine hoists was presented as a paper at the recent meeting of the Nevada Industrial Safety Association. The author is electrical engineer for the Tonopah-Belmont Development Company.—The Editor.)

As Nevada is a foremost precious metal producing state, it is not surprising that she should advance to meet the changes and conditions confronting her. Not so very long ago steam hissed and coughed from every hoist-room of mention; but electricity has now, in nearly every case, supplanted steam.

In the past, the control of electricity—particularly on large hoists—has been a serious and troublesome undertaking, caused by the crude design of both motor and controller. The large electrical manufacturing companies of the world have now reached a higher plane in the late hoist motors; and, I might say, have recently produced some favorable controlling machinery.

A proper control for electric hoists is one that will start a rated load slowly, and increase momentum without jerking, until the required speed of the motor has been attained. And the company that pays the bills for operating this hoist, requires it to be done economically.

Most large electrical manufacturing companies of the country have adopted a remote control operated by a pilot switching device—this pilot switch is usually operated by hand, and, in turn, throws current into large electro-magnets that operate air-valves, or other mechanical devices—while others use electro-magnets directly, in opening or closing switches for control of the hoist. Thus, in one case you must have a small compressor and a motor with large electro-magnets, valves, etc., while in the other you require many electro-magnets, all of which takes a great amount of electric current. I may add, that in Nevada up to the present time electricity has been found rather expensive.

Now, if it stopped there it would not be so bad; but the expense goes on through the controlling circuit. The method of controlling most three-phase hoists in Nevada, is through cutting out the resistance in the secondary, or rotor, circuit of the motors. This is done by most of the big manufacturing companies in six positive steps; every time one of these steps is made there is a surge, or jerk, to the machinery. At the same time there is an unnecessary rush of current until the motor has speeded up to this required energy. Probably some of you have experienced this joker on your automobile with the clutch on; and changed from the low to the second, or to the high speed gear when your car was still, or moving slowly. You might say that one was foolish to do this, as something might break or you might stop your engine. Yes, but you have no flexible way of getting full-speed quickly, although anxious to do so. Your gears are positive, and motion essential; and if it must be done, it will be at the expense of your pocket book.

Therefore, take the hoist-resistance cutout with six positive steps—I say positive because it is a contact between two or more metals—then take the Tonopah-Belmont Electrolytic Control, with its 60 flexible

steps. I say flexible because it is through copper plates $\frac{1}{8} \times 4 \times 24$ in. connected close together on the resistance grids by wires. The tips of those plates coming in contact with a salt solution—instead of metal, as others use—reduces the flow of current in your motor to anything desired, making an absolutely flexible control. So flexible, in fact, that we can cut out the entire resistance and bring to full speed, in about ten seconds, the 300 h.p. hoist geared to a rope speed of nearly 1000 ft. per minute, with a load of about five tons; the ampere meter failing to show when the steps were made. I may say, also, that as high as 1200 amperes have been successfully handled in our secondary circuit. And this with a lever that works horizontally and then vertically, easily operated by the hoist engineer, with one hand.

The horizontal movement switches the current on the primary or stator, of the motor so as to change the direction of rotation. That is to say—the switch standing in the center, would be neutral, or off, position; but by moving the lever to the right gives the hoist one direction, and moving it to the left the reverse. This lever can never make the vertical movement until after the extreme right or left travel has been made. The vertical movement now controls the rotor-speed of the hoist by the gradual immersion of the 60 graduated plates, one after another—that is to say, if the first plate is 16 in. long, the next one would be 15 7-8 in., the next 15 6-8 in. and so on for the entire number. The solution acts as the conductor to bridge, or connect, the plates which are suspended from an insulating fibre, and are one-half an inch apart.

The things that we avoid are:

- a—Those excessive and fluctuating peaks.
- b—The extravagant and unnecessary current at starting.
- c—The jar given the machinery as each of the six sections of the resistance are “chopped” out.
- d—The “kicking” of the power companies at our pulling the generators off their foundations and then letting them “run away.”

And finally—the expense of equipment; installing and maintaining compressors, motors, electro-magnets, switchboards and valves for operating switches to accomplish what the Tonopah-Belmont, and its properties, does so easily by hand.

Standard methods of gas-testing is the subject of a new circular from the U. S. Bureau of Standards. The five principal subjects discussed are: 1. Measurement of heating value; 2. Candlepower determination; 3. Determination of impurities (hydrogen sulphide, total sulphur and ammonia; 4. Taking of gas pressure records; 5. Gas meter testing.

Chemical gaging of water discharge is proving more accurate than either the Pitot tube or the current meter in determining water-wheel performance. A salt solution of known quantity and concentration is introduced above the inlet, and water samples collected below. The relative concentrations indicate the relative flow, from which it is possible to calculate the quantity of flow within 0.1 per cent.

PUBLIC POLICY.

BY F. T. POST.

(After defining the meaning of public policy and the growth of regulation of public utilities, the author calls attention to peculiar conditions now existing in the Pacific Northwest and makes suggestions for remedying them. This paper was presented at the Spokane convention of the N. W. Electric Lt. & Pr. Assn. on Sept. 11.—The Editor.)

Public policy is not synonymous with public sentiment, but, like public sentiment, it may be merely a temporary whim of the majority. Public sentiment does not become public policy until it has been moulded into more or less definite form as a part of the law of the land.

A few of the definitions of the term "public policy," given by the courts, may be of interest.

In the case of Hartford Fire Insurance Company vs. Railway Company, 175 U. S., the Supreme Court said:

Public policy is variable; the very reverse of that which is the policy of the public at one time may become public policy at another; hence no fixed rule can be given by which to determine what is public policy."

In another case that court spoke as follows:

In determining the question what is the public policy of a state and what is contrary to it the court cannot look at general considerations of the supposed public interests and policy of a state beyond what its constitution and laws and judicial decisions make known. The court is not at liberty to travel out of the record in order to ascertain what is against public policy of a state.

The Supreme Court of California defines "public policy" as follows:

"Public policy" is a term of vague and uncertain meaning, which it pertains to the lawmaking power to define, and courts are apt to encroach on the domain of that branch of government if they characterize a transaction as invalid because it is contrary to public policy, unless the transaction contravenes some positive statute or some well-established rule of law.

The Circuit Court of Appeals for the Eighth Circuit, in an important case, uses the following language:

The public policy of a state or nation must be determined by its constitution, laws, and judicial decisions, not by the varying opinion of laymen, lawyers, or judges as to the demands or interests of the public.

From the time of the beginning of traffic and trade between human beings, there has been an irrepressible conflict between the producer and the consumer. Substantially all of the people belong, in a broad sense, to both classes. Those who do not directly produce are connected directly or indirectly with those who do produce or with those who assist in the general business of marketing the product; while the class of consumers, of course, comprise the whole people.

The individual, as a part of the producing class, naturally desires to fix a high price for the product in which he is interested, and as a part of the consuming class desires to fix a low price for the product which he buys. This is illustrated by the general attitude of the farmers of the country who are strong advocates of combinations and organizations which tend to establish and maintain high prices for agricultural products and are opposed to all organizations and combinations having the same tendencies or re-

sults as to manufactured products which they may desire to purchase. Such is the natural bent of the mind of all mankind and it cannot be changed by constitutions, statutes or courts.

At the present time we are dividing the business of the world into two broad general classifications. One we refer to as "public callings" and the other as "private business." We say that the manufacture and sale of gas and electric energy for light and power; the renting of a facility whereby one may talk with another at a distance far greater than the voice would carry without the aid of this facility; the transporting of persons and materials in vehicles for hire along the public roads or private rights of way, are public callings. All of these are great conveniences but not in fact necessities. We say that the selling of flour and of meat and of fruit and vegetables, even in a great city, is a "private business" and not a "public calling," although these things are necessary for the very existence of the people in those cities.

As to the "public callings" it is the public policy that they shall be regulated as to price and service by the public through governmental agencies, and that the owner and proprietor shall not have a free hand in that regard. While as to private business, the owner and proprietor shall be unhampered in fixing prices, except that he shall not enter into any contract, combination or conspiracy with any competitor in restraint of trade or for the purpose of monopolizing or controlling the business, public policy being that with free and untrammelled competition, full protection will be afforded the public.

It is doubtless the belief of most people that the regulation of public utilities by governmental agencies is of modern origin and is one of the great conceptions of the 19th century. As a matter of fact it originated in mediaeval times, due to the necessities of the people; later the law of supply and demand seemed able to cope with the problem and governmental regulation was thereupon abandoned. A bit of ancient history in connection with this subject may be of interest.

Professor Wyman in his book on Public Service Corporations, says:

The mediaeval system involved almost universal regulation of all the doings of men, and therefore its commercial policy was also completely restrictive. The ideal held was a society in which all things were ordered, the full conception being that every man had a right to his place in this established order. This state of affairs was by most men greatly desired. Indeed, a regulated monopoly with the corresponding obligation of public service seemed in that age to the great majority of people far better than unregulated compensation without public obligation.

In those days, as shown by a decision of an English court in 1441, a physician was required to accept any patient who might call upon him and give him his best attention; that profession being then considered a public calling because such professional men were comparatively few and the necessities of the public required such a holding. For the same reason a similar rule prevailed as to the tailor, the blacksmith, the baker and miller.

In 1635 shopkeepers and merchants were forbidden to charge excessive prices by a statute of Massa-

chusetts, and in 1668 the price of boards was fixed by statute in the Plymouth Colony. Professor Wyman says:

Corn and tobacco, beer and bread, beef and boards, all that was most important for the colonists to have was regulated as a matter of course by the assemblies of the time.

In February, 1652, Peter Stuyvesant and his associates, as Directors and Council of New Netherlands, passed an ordinance that reads very much like a modern order of the Public Service Commission. It is an ordinance regulating the rates and service of the company windmill, and reads as follows:

ORDINANCE

Of the Director and Council of New Netherland Regulating the Windmill. (Passed February, 1652.)

Whereas, for a long time past not a few complaints have been made to us of the inconvenience to which the inhabitants are put because they can scarcely get their grain ground, or if ground cannot get it in such a state as it ought to be, for which reason the people are received with abuse, curses and threats, to provide against which as much as possible, and to prevent consequent disorder, it is thought proper, for the better accommodation of our good inhabitants, to appoint a suitable person at a yearly salary to superintend the Honble Company's Windmill, subject to the following Conditions and Regulations to be observed by every one:

1.

The Miller shall be bound and also undertakes as far as the Mill is concerned, to be at the service of all inhabitants, without distinction of persons, and, Wind and Weather permitting, either by himself or by another qualified person, to serve them as far as he is able, both by night and by day, as opportunity may offer, according to the proverb—First come, first served; also First come, first to be waited on; wherein no one shall consider himself preferred except only the Honble Company which has usually 70 or 80 persons to provide with bread.

2.

None of the inhabitants, whether servant or Freeman, shall be at liberty to carry any grain to the Mill, neither shall the Miller receive any grain into the Mill, without first having obtained a permit of the Office of the Store, whereupon the quantity and quality of the grain are set forth.

3.

In order to make the Clerk more willingly accommodate, and more attentively wait on the Commonalty, One stiver shall be paid him for a permit for 3 skepels and over; half a stiver for a permit under 3 skepels; For toll on each skepel shall be paid three stivers in silver money, or good stringed Wampum, or commodities to the Miller's satisfaction.

4.

The Miller shall register the permits received in order, whenever required by the Director and Council, to render an account of the Toll, to be compared with the Clerk's Register or account book, and he shall not give credit to any one for toll, except at his own risk.

5.

Whereas the Revenue from the tolls ought to defray, besides the Miller's yearly salary, the expenses of the maintenance and improvement of the Mill, for which good pay is required, no person shall trouble or annoy the Miller or his man, by words much less by deeds, in case he refuse poor or unassorted Wampum, but herein apply the common Proverb—Many can carry more than one.

6.

To prevent frauds, evil reflections and especially after-claps, Weights and Scales shall be placed at a proper time in the Mill, in order that those wishing to do so may deliver in their grain at the scale and receive it back again, accord-

ing to the Regulation formerly made there, or according to circumstances, hereafter to be enacted.

7.

For the convenience of raising and lifting, no one shall be at liberty to bring more than three skepels in one sack to the Mill, or calculate less toll than for one spekel.

8.

Finally, in order to prevent all disputes, the Miller, on his promise and word, is intrusted with the grinding of every thing at the stated rates, wherewith every one ought to remain satisfied; but if on an extraordinary occasion any one would have the Meal very fine and twice ground, if it can be done without great inconvenience to others, he may be accommodate, at the discretion of the Miller, with one or two runs through (the mill) on payment of three pence per skepel.

Thus done and enacted the February, A° 1652 in the Council of the Honble Director General and Council of New Netherland.

P. STUYVESANT,
LA MONTAGNE,
BRIAN NEWTON.

Regulation of any and all business and callings had practically ceased in the first part of the 19th century. Public policy was opposed to the regulation of all private business, and public callings were practically restricted to transportation companies and innkeepers. The sentiment of the time is illuminated by a decision of the Supreme Court of New Jersey in 1858, in which it was held that a gas company in the city of Paterson was a private business. The question was whether the Paterson Gas Light Company was bound, under the law, to furnish gas to all buildings on the lines of their main pipes upon the applicants therefor agreeing to pay the fixed price and agreeing to comply with all reasonable regulations established by the company. The court, among other things, said:

That no such duty arises out of the mere facts that the company made gas, laid pipes in the streets, and actually furnished it to many persons, may be safely assumed. Innkeepers and common carriers are bound to receive all who properly apply to them, but this is a duty peculiar to them.

We find in this opinion some further language that was in accord with the thought of the nation at that time, but which would seem most remarkable at this time to any court or student of public questions:

The Paterson company is authorized to make and sell gas, which, in the absence of any indication to the contrary, implies that they may fix their own price, and choose their own customers, like any other manufacturer. If the duty of furnishing gas to those requiring it was meant to be imposed, it would doubtless be expressed, and not be left to mere inference. If it is to be inferred, what is to be the limit? Why have not all the inhabitants of the town the same right to demand it as those having buildings on the streets along which the pipes are placed? The charter sets forth the general purposes of lighting all the streets and buildings, and the court below seems to have held that the company has no choice in the matter. But what company in the state, or elsewhere, could have ventured to have assumed such a responsibility as that?

In a few years a great change had come over the body politic, as is shown by a decision of the Supreme Court of the United States in *Munn v. Illinois*, 94 U. S. 113, decided at the October term, 1876. It appeared that the legislature of the state of Illinois had passed a statute regulating service and rates of grain elevators and warehouses generally and the policy of

that statute was questioned by an owner of such a warehouse constructed before the passage of the act. Chief Justice Waite writing the opinion of the court, said:

Under these powers (police powers) the government regulates the conduct of its citizens one towards another, and the manner in which each shall use his own property, when such regulation becomes necessary for the public good. In their exercise it has been customary in England from time immemorial, and in this country from its first colonization, to regulate ferries, common carriers, hackmen, bakers, millers, wharfingers, inn-keepers, etc., and in so doing to fix a maximum of charge to be made for services rendered, accommodations furnished, and articles sold. To this day, statutes are to be found in many of the states upon some or all these subjects; and we think it has never yet been successfully contended that such legislation came within any of the constitutional prohibitions against interference with private property.

The court finds as a fact that the grain elevators in Chicago are so located as to practically monopolize the business and that such business is of vital importance to the whole people, and then says:

Under such circumstances it is difficult to see why, if the common carrier, or the miller, or the ferryman, or the inn-keeper, or the wharfinger, or the baker, or the cartman, or the hackney-coachman, pursues a public employment and exercises "a sort of public office" these plaintiffs in error do not. They stand, to use again the language of their counsel, in the very "gateway of commerce," and take toll from all who pass. Their business most certainly "tends to a cocoon charge, and is become a thing of public interest and use." Every bushel of grain for its passage, "pays a toll, which is a common charge," and, therefore, according to Lord Hale, every such warehouseman "ought to be under public regulation, viz., that he * * * take but reasonable toll." Certainly, if any business can be clothed "with a public interest, and cease to be *juris privati* only," this has been.

Two very able judges dissented from this opinion, namely: Justice Field and Justice Strong, and Justice Field wrote a very vigorous dissenting opinion, beginning with these words:

I am compelled to dissent from the decision of the court in this case, and from the reasons upon which that decision is founded. The principle upon which the opinion of the majority proceeds is, in my judgment, subversive of the rights of private property, heretofore believed to be protected by constitutional guaranties against legislative interference, and is in conflict with the authorities cited in its support.

The statutory law in this country is now in such an inconsistent and chaotic condition that it may be doubted if there really is any settled public policy at this time as to either public callings or private business.

As to private business, we have the Sherman Anti-trust act, which forbids all contracts, combinations and conspiracies in restraint of trade, the purpose of which is to insure competition, and statutes of similar character in some of the states and the decisions of the courts under the Sherman Act that such competition shall not be of a ruinous character, but carried on in a gentle manner.

Apparently the present public policy as to private business is that one shall not sell an article at or below cost, as that might drive his competitor out of business or compel him to sell out to the other party. A "fierce trade war," to use the expression of the Supreme Court in the American Tobacco case, might

come within the inhibition of the Sherman Act. Only mild and gentle competition is apparently allowable but that is required, and failure of compliance is statutory criminal conduct. Not satisfied with the efficiency of such gentle competition, the real or imaginary sentiment of a part of the people is now calling for the enactment of a statute providing for a Trade Commission, with inquisitorial powers, who will by indirection determine the price to be paid for the products of private business, not including agricultural products. This statute has now passed both houses of Congress with certain differences which will shortly be disposed of in conference. Private business will be no longer private. Prices will be regulated through the publicity given by the government commission and through mild competition and the millennium will be here for a few days.

Public policy as to public callings, commonly called public utilities, is in a condition of inconsistency. The commission statutes generally provide that the service shall be of the best and that the rates shall be just, reasonable and adequate and the commissions are given plenary powers to enforce these requirements. The Sherman Act, supplemented by various state statutes, prohibits all contracts, conspiracies, combinations and methods of any kind or character which tend to restrain competition. Under the commission statutes the rates cannot be raised or lowered without the consent of the commission. The rates of two companies occupying the same field, must of necessity be identical. An agreement as to such rates would be in violation of the anti-trust acts. But as a matter of fact competition as to rates is an impossibility. The public is interested in rates being adequate. An inadequate rate is an unreasonable rate. Adequate service is an impossibility when the rates are inadequate. Under the statute the rates cannot be above reasonable rates. The law demands first class service. The commission has the power to compel it. The field for competition between two companies is of necessity very small, but competition is enjoined by the anti-trust acts. The public policy of one statute conflicts with the public policy of the other statutes.

The public policy of regulating commission statutes recognizes the waste of wealth in duplication of plants, and that not only is the consumer amply protected by the power conferred on an unbiased regulating commission to fix rates and regulate service, but also that the owners of public utilities can afford to sell the product or service on the basis of a lower rate of return when they are protected by the government from unnecessary competition. That is one of the underlying theories of regulating commission statutes, especially exemplified in those states where the statute provides for a certificate of necessity before any plant can be constructed. As opposed to the theory of these statutes are the other statutes compelling competition and waste. It is manifest that if any company is compelled to turn over its business to some governmental agent with power to fix rates and order extensions and improvements to plant and to determine what is a fair rate of return on its investment, that such company is entitled to protection from the government against unnecessary duplication

of plant from any other company and from the results of wasteful competition.

In Washington we have a most anomalous condition. The statute provides that service shall be of a high grade and all rates reasonable and there shall be no discrimination as to rates, except when the public utility is owned by a municipality. Where there are two plants in competition within the borders of a municipality, one privately owned and the other owned by the municipality itself, the municipally owned plant is a free lance, may fix rates below cost, if it pleases, may discriminate as to rates and do various other things which if done by the privately owned plant would subject the officials thereof to punishment under the statute.

Public intelligence has grasped the economic principle that duplication of plant is destructive of wealth and not beneficial but injurious to the public; that unless the owners of public utilities are allowed a reasonable rate of return high grade service is an impossibility and the public must eventually suffer.

Regulation by direct act of the state legislature has been tried out and discarded as a failure. Such a body does not have the time to make a careful investigation and some of the questions involved require long and careful study and technical knowledge. Regulation by politicians is a manifest absurdity. This has been demonstrated under laws that permit the fixing of rates by the councils of municipalities. This method has been given a fair trial in this country and generally discarded. Only a very cities are hanging on to this obsolete system.

The owners of public utilities are entitled to a fair trial before an unbiased tribunal who will have the means to make a thorough investigation of the value of the plant and of all other matters involved and who will be uninfluenced by the coming election or the pledges given before the last election, or the insistent demands of constituents or newspapers, or any other fact or circumstance outside of the material evidence given at the hearing. A candidate for the council who advocated the reduction of gas rates on the stump would be in an awkward position to sit as a judge to decide this question according to the evidence, without bias and without prejudice.

The statutory law of many of the states needs to be changed to make public policy accord with enlightened public sentiment. I venture to suggest a few amendments.

The Interstate Commerce Commission statute provides that not more than a bare majority of that body shall be appointed from the same political party and that the term of office shall be seven years. The states would manifestly do well to adopt similar provisions. A Public Service Commissioner should manifestly remain in office so long as he is doing his work honestly, efficiently and courageously and should not be subject to removal because his political affiliations may not be the same as those of a newly elected executive.

The constitution of many of the states forbids a judge of a court of record from being a candidate for any office, except a judicial office, during the term for

which he was elected or appointed. The wise purpose of this provision is to keep judges strictly out of politics. There should be a similar provision as to public service commissioners.

That the principles of law applicable to one public utility do not apply to another public utility engaged in the same business and in competition with the first, is so manifestly unjust that it is almost unbelievable that such a condition should exist anywhere. And yet it does exist in the state of Washington.

The names or the status of the owners of a public utility are not of the slightest importance. Intelligent public sentiment is opposed to rate wars and discriminations. There are two electric light plants in a great city, one privately owned and the other owned by the municipality. The privately owned is forbidden under severe penalty, from discriminating between patrons of the same class as to rates. It must sell in accordance with its published rates; it cannot carry on a rate war. The publicly owned is a free lance and in going after business may do all of the things that the law forbids the other. That is not fair competition; that is not fair warfare. It is assassination.

In most states a public utility, although regulated as to rates and service by one governmental body, obtains its rights or privilege of going into business or continuing in business from some other political body. It may have been in business for a quarter of a century, serving the public carefully and well and complying with all orders of the regulating bodies, and then may be put out of business by another political body, without cause or excuse. This is unscientific and illogical. The policy of the regulating body is to establish rates of service to the people as low as possible. The public utility is entitled to a reasonable rate of return. The question of its annual expense enters vitally into the problem of rates. Pulling in the other direction is another political body that alone has the power to permit the public utility to do business in a municipality. This political body takes the position that a franchise to run pipes or conduits below the surface of the street, or a pole line close to the sidewalk is very valuable and that the public utility should pay annually some considerable sum of money to the municipality, and shall give free service and other things of value to the municipality, thus increasing the cost of operation, which must be reflected in the rates. This political body also takes the position, under the law, that the franchise shall be for only a few years and at the end of that period of time the public utility must come again to this political body and get a renewal of this franchise, otherwise go out of business, and when the time for renewal comes the public utility is at the mercy of this political body, because the public utility has a large investment in the municipality and is required, under penalty of confiscation or destruction of its property, to accede to all requirements of the political body, no matter how unjust or unreasonable they may be. Such is the so-called public policy at the present time in the Northwest.

Nearly all of the present statutory law in relation to regulation of public utilities by commission has been enacted within the last decade. So it may be

said that commission regulation is in its infancy. No public body has greater power for good or evil than these commissions. The public and the public utilities should never lose sight of the fact that the best interests of the public and the public utilities are identical. For instance, the waste from duplications of plant is an injury to both the public and the public utilities, upon the same principle that the destruction of the property of the individual in this horrible European war is a great injury to the whole public in Germany, France, Great Britain and Russia, and as well in the United States and in all other parts of the civilized world. The same principle applies when there is destruction of wealth by the construction of two municipal electric plants when one plant will efficiently serve the public. The expenditure of a million of dollars in constructing a marble palace or a series

of dry wells in the Desert of Sahara means a million dollars lost and the whole world is that much poorer. It is in fact of as much interest to the whole people that the owners of public utilities receive a fair and just rate of return upon an intelligent investment as to the owners themselves. Without it good service cannot be given and all progress must cease. Enlightened public sentiment accords with the views of the wise managers of public utilities. Unfortunately, public policy as defined in our statutes is lagging behind enlightened public sentiment. Progress, development and universal prosperity require frank, free and broadminded co-operation between the students of economics, the members of regulating commissions and the managers of public utilities with the end in view of making statutory public policy keep pace with the best thought of the nation.

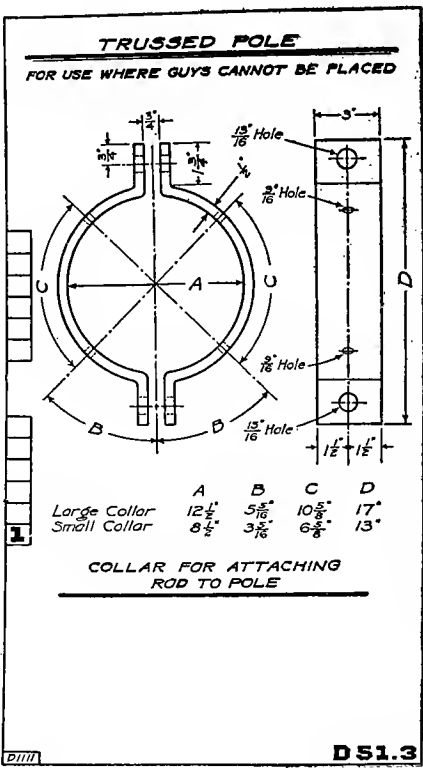
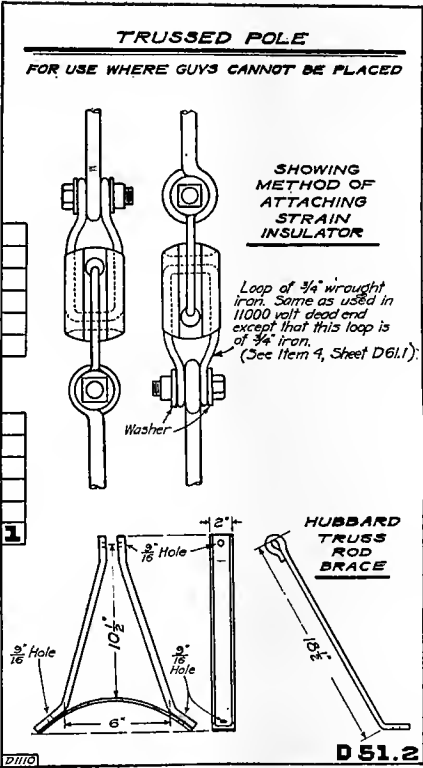
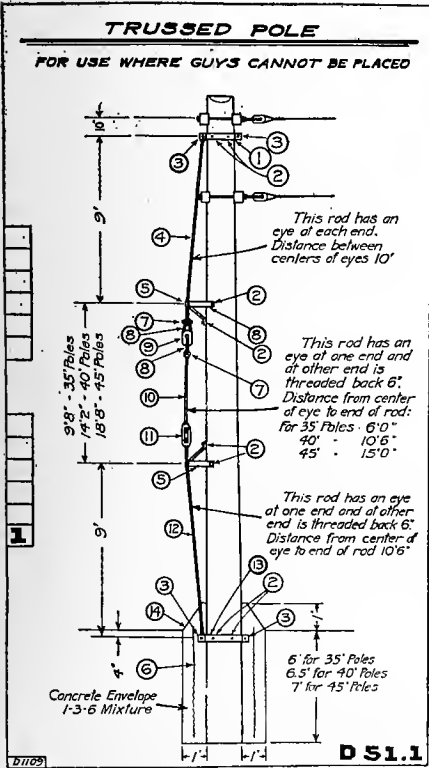
ELECTRIC DISTRIBUTION
ELECTRICAL STANDARDS IN SAN DIEGO.

D. Overhead Construction.

BY L. M. KLAUBER.
(Concluded.)

The accompanying plates show standard construction for a trussed pole to be used where guys cannot be placed. These have been developed recently and should be considered in their proper sequence between D 50.8 and D 50.1. The method of attaching the strain insulator and also the details of the collar attaching the rod to the pole are shown. The standard bill of material is as follows, all metal parts being painted with one coat of Glidden's acid-proof coating and one coat of Dixon's black graphite :

Item.	Bill of Material.	Quantity.
1-8 1/2 in. collar		1
2-1/2 in. x 3 1/2 in. Galv. Lag Screws		14
3-3/4 in. x 3 in. Machine Bolts		4
4-3/4 in. Rod-See Sheet D 51.1		1
5-Hubbard Truss Rod Brace		2
6-1 pc. 1 in. mesh Netting 6 ft. x 7 ft.		2
7-3/4 in. x 21 in. Machine Bolts		2
8-Wrought Iron Loops		2
9-5 1/2 in. Brown Por. Strain Insulator		1
10-3/4 in. Rod-See Sheet D. 51.1		1
11-3/4 in. x 8 in. Turnbuckle		1
12-3/4 in. Rod-See Sheet D 51.1		1
13-12 1/2 in. Collar		1
14-Concrete Base of 1-3-6 mixture.		
Material required:		
35 ft. pole	Cement. 8 sacks	Sand. 24 cu. ft. Stone. 48 cu. ft.
40 ft. pole	9 sacks	26 cu. ft. 51 cu. ft.
45 ft. pole	9 sacks	27 cu. ft. 54 cu. ft.



JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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Correction.—A personal mention in this journal of September 5th gave the erroneous impression that the National Carbon Company of Cleveland, Ohio, was a works of the General Electric Company. The National Carbon Company advises that it is independent of all commercial and other alliances, and has requested that due notice be made of this fact.

In these stirring war times the intense loyalty of the different peoples in serving their respective countries induces a responsive thrill in the breast of every true man. Ever has it been thus, war and loyalty, a spectacular service fanning into flame the smoldering coals of loyalty. Loyalty, literally faithfulness to the law, always appears when law and order are threatened.

Yet it is not right to view the warrior as the one type of loyalty. Every service, no matter how humble or obscure, requires loyalty for its fulfillment. Consider the patriot, the martyr, the mother. Loyalty is the actuating impulse of service.

Here then lies the lesson for every man who realizes that "he profits most who serves best." Only the loyal are on the royal road to service; their reward, their royalty if you will, is commensurate with their loyalty. Especially is this true for the employe of the business corporation which makes service to the buying public its prime object. Be loyal.

In being loyal you help yourself infinitely more than you help your employer. Josiah Royce has said: "In loyalty, when properly defined, is the fulfillment of the whole moral law." He defined loyalty as "the willing and practical and thorough going devotion of a person to a cause."

This one idea contains the essence of the teachings of the sages of all ages. The loyal man is true, he is just, honorable and charitable; he is unselfish, self-controlled and in love with his cause. Whether exemplified as the devotion of the mother, the self-sacrifice of the Samurai, or the fortitude of the martyr, loyalty is the acme of virtue. Nor is this a mere moving-picture of platitudinous praise, but rather a suggestion to be actively applied in every man's life, in the home, in the business and in the nation.

The salesman can be loyal to his cause, the house for which he is working. He can express his individuality in striving for its profit. He has chosen his cause. Let him believe in it, let him freely devote his energy and enthusiasm to its accomplishment. The same phase of loyalty which is active as fair play in sport, or a chivalrous respect for the adversary in war, should characterize his treatment of competitors. His ultimate success will probably be in direct proportion to his loyalty.

The public utility official has a chosen cause, the service of the public. Let him perform that service willingly, graciously, courteously. He will find that loyalty is contagious, that his loyalty to his cause will attract the loyalty of others to him and his cause. If his cause be subject to untoward attack it is the more susceptible to loyalty, which always is strengthened by the buffeting of misfortune.

The banker has now great need for loyalty to his country. Indeed the accusation is made that the present money stringency is largely due to the disloyalty of the bankers in refusing assistance to worthy

plans for development. The needs of America should take precedence over European loans. The benefits of loyalty are in a large measure dependent upon the cause. If the cause be a predatory one, such as a pirate band which lives by overthrowing the loyalties of others, it involves disloyalty to the spirit of loyalty itself, and its benefits are for the few rather than the many. Thus while loyalty is good for the individual man, it may be disastrous for those whom his cause assails.

Loyalty binds many individuals into one service, one unified cause, which lifts them above their petty differences. It makes men consult socially so as to define the purpose of their lives. It brings wide tolerance of the sincere beliefs of other men, inculcates decision and makes for faithfulness. Its principles are instilled by the idealization of the cause and by the knowledge that loyalty to loyalty invariably pays.

The efficiency of a small business is usually determined by comparing out-go with income. The business is a paying venture if this ratio be an improper fraction and is a losing one if it be proper. With a large business where this method is impracticable or where the efficiency is near unity it is better to find the losses and add them to the out-go to determine the income. The manifold advantages of the latter method has caused the adoption of a system of corporation book-keeping which will show where the loss as well as the gain takes place. It is essential that a manager know this and his success is often determined by his ability to minimize the loss.

There is probably no industry in which the efficiency of apparatus is more closely determined than in the electrical business where standards have been adopted and the results of physical investigation applied. It may be due to this fact that the electrical business is leading all others in the attainment of uniformity in accounting. Such is true not only in central station, railway, and telephone practice, but also in the manufacturing and selling end.

The first requirement in this arithmetical problem in ratio is to reduce to some common denominator the many factors that enter into it. This denominator depends largely upon the character of the business and the purpose to which the figures are to be applied; in traction work it may be the ton-mile, in central station the watt-hour, and in telephone practice the wire-mile or the station, and in general is some factor involving time, space, weight or wage. These factors are as varied as the forms of business enterprise that they comprise and include much data which may appear extraneous. Adopting the electrical analogy, the efficiency of a business as a whole varies with good or bad times much as that of an electrical system depends upon its load-factor. Internal friction, such as conflicts between employer and employee, have a great bearing on business success. Competition has many points in common with resistance, and freight charges and drayage with transmission and distribution.

Such comparison might be continued indefinitely but it is of merely passing interest. Whereas the greatest efficiency losses usually occur in the motors of an electrical system, so in a business it is upon the efficiency of his subordinates that the manager of a great corporation must rely. No standardization of routine yet devised will eliminate the personal equation. Yet great success is being obtained by setting a standard which gauges a man's efficiency by his record of performance. To the man this acts as an incentive for improvement and to the manager it indicates the unfit, who must obey the usual law of survival.

It is difficult to find an article in the technical press which does not contain some comparison of different ways of doing the same thing. Such comparison may be either direct or implied. It is sometimes obvious and sometimes veiled. The

The Point of View

advantages of one method are listed against those of another and evidence is presented as to why the one should be adopted. The intent is to show that certain apparatus is better than any other. These articles are usually written by unbiased engineers incorporating the results of their personal experience. But "what is one man's meat is another's poison," and what is one man's success may prove to be another's failure. No method should be adopted or discarded on the dictum of one observer, for we are all liable to err. It is only from a consensus of competent opinion that fair judgment can be given. A method which is acceptable to a theorist may be of little value in practice, whereas the practical "rule of thumb" may prove cumbersome and unsatisfactory for scientific work.

A good machine in poor hands or under adverse conditions may make a poor showing as compared with a less efficient one properly run. This has been demonstrated many times in tests of steam turbines and reciprocating engines. Requirements may differ so that what is good under one set of conditions is of no value under another. An impulse water-wheel would offer little competition to a gas engine in the Sahara desert, and one match would be worth more than a carload of electric cigar-lighters at the South Pole.

Furthermore, it is possible for a method to be at once the best and the worst. An example of such duality was afforded recently in an advertising competition in which the same copy was entered by two people, one of whom considered it the best and the other classifying it as the worst. Both opinions were accompanied by good evidence to support their contentions and both were right—from their own viewpoint. The most brilliant diamond is lusterless in some lights and from certain angles the imitation may rival the genuine.

These examples all show how unstable is the sensitive balance which determines the superior and the inferior. It sways with the slightest change in external conditions, its counterpoise is unprotected and parallax causes many a mistake. Even the equilibrium established by time is liable to change at any moment when some new method, perhaps once condemned, takes the place of the old, tried and true though it be.

Efficiency Standards

PERSONALS

E. C. Eaton, hydroelectric engineer from Idaho, is at San Francisco.

K. G. Dunn, vice-president Hunt, Mirk & Co., Inc., of San Francisco, is at Seattle.

Geo. J. Henry, hydraulic and mechanical engineer, has returned to his offices in San Francisco.

F. W. Milenz, manager Napa Valley Electric Company, has returned to St. Helena from Los Angeles.

Geo. D. Smith, supervisor of agencies of the General Vehicle Company, New York, is at San Francisco.

Frank J. Somers, proprietor Century Electric Company, San Jose, is spending a few days in San Francisco.

W. F. Williamson, vice-president of Van Emon Elevator Company, leaves this week on a trip to New York.

C. V. Schneider, manager Electrical Supply Company, Sacramento, spent a few days in San Francisco last week.

C. C. Hillis, vice-president of Electric Appliance Company, has returned to San Francisco from a visit to Chicago.

Jos. C. Hobrecht, electrical contractor at Sacramento, made a short trip to San Francisco, the latter part of last week.

J. T. Euclis of the Kern Valley Electric Company, Bakersfield, California, was a visitor in San Francisco during the week.

Geo. Bundy of the firm of Pease, Bunday & Taylor, Porterville, California, spent a few days in San Francisco during the week.

O. A. Schlesinger, Pacific Coast manager U. S. Light & Heat Company, storage battery manufacturers, is at Los Angeles.

T. E. Bibbins, local manager General Electric Company at San Francisco, has returned from a trip through Southern California.

W. L. Frost, distributing agent Southern California Edison Company at Redlands, California, spent his vacation in San Francisco recently, being duly and properly amazed at all he saw.

S. K. Colby, formerly vice-president Pierson-Roeding Company, who has been visiting in California for several weeks, has returned to the East.

James I. Colwell, manager Seattle-Portland branch Western Electric Company, spent the week end at the Jobbers' convention at Del Monte.

H. W. Phillips of Washington, D. C., has been visiting the Coast in the interests of the associated independent electric elevator manufacturers.

L. H. Mace, city representative Electric Railway and Manufacturing Supply Company, has recently severed his connections with that company.

Paul A. Shilton, Los Angeles, representative of R. J. Davis, sales agent for Century motors, has been visiting the cities of Southern California.

A. G. Jones of the engineering department General Electric Company, San Francisco, recently returned from a several weeks' trip through Nevada.

R. J. Davis, western representative Century Electric Company, St. Louis, leaves for the East October 2d, where he expects to be for about thirty days.

H. C. Goldrick, Pacific Coast sales manager Kellogg Switchboard & Supply Company, returned from a business trip throughout Southern California.

H. H. Cudmore, director Mazda bureau of General Electric Company of San Francisco, was the guest of Hal Laur-

itzen and party on an automobile trip throughout the San Francisco bay region last Sunday.

C. W. Harris, professor of civil engineering at the University of Washington, Seattle, while on a year's leave of absence, is devoting his attention to the development of small water powers in the Cascade Mountains.

F. W. Gillan, in charge of the pole department of Pierson, Roeding & Co., has returned to San Francisco after an extended visit to the Northwest, where he visited the mills, yards and forests of the company he represents.

Geo. A. Wooley, manager of the supply department of the General Electric Company at Denver, is at Salt Lake City on his regular trip of inspection of the local offices there whose business is handled through the Denver office.

E. J. Kulas, president of the Tungstolier Company, has succeeded **V. R. Lansingh**, as manager of the Glass and Metal Reflector Divisions of the National Lamp Works of General Electric Company, Mr. Lansingh having resigned to become connected with the Hardware Buyers' Association of Chicago.

H. F. Yost, formerly with the Electric Stores of Sacramento, has joined the forces of the Electric Railway and Manufacturing Supply Company of San Francisco; **H. H. Hoxie**, formerly with the Crocker-Wheeler Company of Los Angeles, will join the same company about the first of the month, and will represent the manufacturing department in San Francisco; **B. Y. Gibson** has recently severed his connections with the company.

OBITUARY.

C. N. Felton, president of the Snow Mountain Power Company and formerly United States Senator from California, died at his home in Menlo Park, California, on September 13, 1914, after an illness of two weeks. Senator Felton came to California in 1849, being 82 years of age at the time of his death.

Chas. W. Quilty, for many years president of the San Jose Light & Power Company, and second president of the Pacific Coast Gas Association, died at San Jose, California, September 22, as the result of a general breakdown. He was a prominent figure in the early California light and power developments and a son-in-law of the late James A. Hagan.

MEETING NOTICES.

Sacramento Jovian League.

On Wednesday, September 16th, the Sacramento Jovians held their usual weekly luncheon at the Peerless Cafe. Mr. H. H. Cudmore, Chief Stentor of the Jovian Order, gave an interesting and instructive talk on Jovianism in Commercial Co-operation. His remarks were much enjoyed by the large number in attendance, several San Francisco Jovians being among the number.

Electrical Development and Jovian League.

The regular weekly luncheon of the Electrical Development & Jovian League of San Francisco was addressed on September 22 by P. F. Valentine, professor of history at the San Francisco State Normal School. He reviewed in masterly manner the possible effect of the European war on American business. The league took action condemning the practice of the municipal plant at Alameda in selling lamps and appliances below established prices and indorsed the electrical page now appearing every other week in the San Francisco Call.

San Francisco Section A. I. E. E.

The first meeting of the 1914-15 season of the San Francisco Section American Institute of Electrical Engineers was held at the Engineers' Club, Friday evening, September 25th. L. F. Fuller presented an interesting paper on "Daylight Absorption in Long Distance Radio-Telegraphy."

San Francisco Section Electric Vehicle Association of America.

The first open meeting of the San Francisco section was held at the rooms of the Engineers' Club, Thursday evening, September 17th and judging from the large attendance and interest displayed, the success of the local branch is assured.

The speaker of the evening was C. H. Hutton, local representative of the General Vehicle Company, who presented a paper on "Merchandise Delivery Costs," graphically illustrated by comparative cost charts. Discussion of the subject was indulged in by those present and Mr. George Drake Smith, the guest of the evening, was introduced. Mr. Smith has recently been appointed agency manager of the General Vehicle Company. During his trip from New York to the various Pacific Coast agencies, the vehicle men of San Francisco prevailed upon him to meet with them at their opening meeting and tell them of the work of the National Vehicle Association, of which Mr. Smith's brother is president. The speaker dwelt at length on the organization's work and gave his hearers much interesting and instructive data in the marketing of electric vehicles.

Jovian Electrical League of Southern California.

With characteristic enthusiasm and a feeling of comradeship which breathed the very spirit of commercial co-operation, the Southern California Jovians assembled in Los Angeles for the season's first luncheon at Christopher's on Wednesday, September 16th. About 125 Jovians were seated at the tables when Chairman Colkitt extended his greetings and requested everyone present to announce his name and firm affiliation, so as to insure a thorough acquaintanceship. Most of those present wore their white ribbons emblematic of Jovian day. A splendid musical program was arranged by Stentor Morphy, through the courtesy of Manager Quinn and the singing and playing of Miss Sutter and Mr. Alser were thoroughly appreciated. The chairman of the day, F. F. Foster, then introduced Superior Court Judge Craig, who spoke on "Criminology." He explained the aims and purposes of the California Institute of Criminology, namely to effect reforms and prevent crime. He pointed out the necessity of treating criminals as individuals and not as a class. He favored the giving of employment to criminals and that the proper care and study of the criminals was a matter of economy to the state. He not alone works for his own support but also those dependent on him. He spoke highly of the San Diego Municipal Farm where each criminal receives fifty cents per day and his board.

Another interesting talk on the "The Prevention of Industrial Accidents" was given by R. L. Eldringham, safety engineer of the California State Accident Commission. He advocated the establishment of a national Bureau of Industrial Safety. He stated that 35,000 persons are killed in the United States through accidents each year, or one every fifteen minutes, most of which are preventable. He referred particularly to the necessity and ease of guarding against electrical accidents. Forty per cent, he argued, could be prevented by mechanical safeguards and 60 per cent of the total 90 per cent of preventable accidents, by education. He warned his hearers against forming the "I should worry" habit.

NEWS OF IDAHO PUBLIC UTILITIES COMMISSION.

The commission has granted to Dumble Bros. a certificate for the construction and operation of a system for the generation, transmission and distribution of electrical energy in the village of Plummer, Idaho.

At the request of the Washington Water Power Company its application for a franchise at Kendrick, Idaho, has been dismissed.

The complaint that the Idaho-Oregon Light & Power Company had not furnished service to Donald H. Davis was dismissed upon evidence that current was now being furnished the complainant.

With regards to the complaint of several milling companies in the upper Snake River Valley that the rates of the Utah Power & Light Company were unreasonable, the commission ordered that the hearing be continued until December 1, 1914, until a proper schedule can be determined. Meanwhile the company is authorized to collect the former rates with proviso that any excess or deficiency be refunded or collected when final decision is made.

An order has been issued granting the Wood Livestock Company, Ltd., permission to construct an electric light and power system at Spencer, Idaho. There was no public hearing on the matter as the territory which the company intends to serve is not now supplied with electric power and the new company will not be encroaching on territory already entered by any rival concern.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Union Home Telephone & Telegraph Corporation, operating in the counties of Orange, Los Angeles and San Bernardino, has filed an application requesting authority to renew for a period of one year promissory notes totaling \$24,700.

The commission has authorized the San Joaquin Light & Power Corporation to renew promissory notes totaling \$64,156.48 for a period not to exceed one year.

The commission has issued a supplement to its order permitting the Fowler Gas Company to issue \$15,000 of 10 year 6 per cent bonds, in which it provides that the bonds shall be issued so as to net the applicant not less than 85 per cent of their par value.

The commission has issued a supplemental order authorizing the Southern California Edison Company to sell \$187,000 face value of its bonds to the Harris Trust & Savings Bank of Chicago. The bonds are to be sold at not less than 87½ and the proceeds will be used to discharge a note of \$150,000 held by the savings bank. Any remainder will be turned into the company's treasury to be used in such manner as may be permitted by the commission.

The Pacific Light & Power Corporation has filed an application with the commission asking authority to issue to trustee 170 of its first and refunding mortgage bonds at a price acceptable to the commission.

The commission has rendered a decision authorizing the Snow Mountain Water & Power Company to transfer and lease certain of its properties in Mendocino County to the California Telephone & Light Company in return for a promissory note amounting to \$790.18.

NEWS OF WASHINGTON PUBLIC SERVICE COMMISSION.

The following causes have been set for hearing:

1607. September 30, 9:30 a. m., R. A. Morris vs. Puget Sound Traction, Light & Power Company, street car route.

1748. October 1, 9:30 a. m., Seattle, City of Seattle vs. Seattle, Renton & Southern Railway and Scott Calhoun and Joseph Parkin, receivers. Increase rates.

1539. October 6, 9:30 a. m., Seattle, F. W. Browne vs. Pacific Northwest Traction Company. Rates.

1648. October 6, 9:30 a. m., Commission ex rel. O. J. Travis et al. vs. Pacific Northwest Traction Company, Everett Light & Water Company and Puget Sound Traction, Light & Power Company. Commutation tickets.

1723. October 8, 9:30 a. m., Seattle, Commission ex rel. City of Seattle vs. Puget Sound Traction, Light & Power Company, Seattle, Renton & Southern Railway, and Scott Calhoun and Joseph Parkin, receivers. Transfers.

1741. October 9, 9:30 a. m., Seattle, Commission ex rel. B. Weiman vs. Richmond Beach Telephone & Power Company. Service.

1760. October 14, 9:30 a. m., Port Townsend, Commission rel. City of Port Townsend vs. Key City Light & Power Company. Rates, etc.

1700. October 20, 9:30 a. m., Everett, Commission ex rel. Geo. T. Hendrie et al. vs. Everett Gas Company. Rates.

PACIFIC COAST GAS ASSOCIATION CONVENTION.



The twenty-second annual convention of the Pacific Coast Gas Association, which was held at Long Beach, Cal., September 15-19, was voted the most successful meeting ever held by the Association, not only due to the character of papers which were presented, but to the general interest manifested in the papers by the members in attendance. Mr. Champ S. Vance of Los Angeles presided.

The appliance exhibit was one of the best ever given under the auspices of the Association and was an extremely creditable exposition, to which the public were invited.

The ball on Wednesday evening, September 16, was a brilliant success, the banquet on Thursday evening was voted the best ever, and the outing to Catalina on Friday was an affair enjoyed by all.

The authors of the composite papers on the "General Utilization of Gas," Messrs C. B. Babcock, R. J. Thompson, B. S. Pedersen, H. P. Pitts and H. S. Basford, were, upon motion made before the convention, awarded each a gold medal for their efforts. The paper by D. E. Kepplemann on "Welding in Gas Distribution" was heard with considerable interest.

One of the important matters taken up was the International Gas Congress, which is to convene in San Francisco in September, 1915, and Mr. John A. Britton, chairman of the local committee, gave assurances that the Association would be prepared to act as host and maintain the usual standard of California hospitality.

The following were elected to serve as officers and directors for the ensuing year: President, E. C. Jones, San Francisco; vice-president, Frank A. Cressey, Jr., Modesto; secretary-treasurer, Henry Bostwick, San Francisco; directors—Messrs. John A. Britton, San Francisco; C. O. G. Miller, San Francisco; W. B. Cline, Los Angeles; W. G. Kerckhoff, Los Angeles; V. W. Papst, Portland, Ore.; C. B. Babcock, San Francisco; Robt. J. Thompson, San Francisco.

Mr. Harry L. Strange of Honolulu was in attendance, which added considerable zest to the meeting, and at the banquet expressed a desire that the Association might arrange to hold a meeting in Honolulu at some future time, and at the same time extended a cordial invitation to the Association so to do, assuring the members that the citizens of Honolulu would leave no stone unturned toward making their visit a pleasant one.

TRADE NOTES.

Walter L. Rodgers, San Francisco, has installed a 200 h.p. Diesel internal combustion engine at Solomon, Alaska, to operate a gold dredge.

The A. G. Electric Manufacturing Company of Seattle has recently installed switchboards for the Pantages and Liberty theatres at Seattle and the Orpheum at Portland.

The Board of Public Works of Los Angeles has requested bids for the installation of ornamental lighting fixtures on Wilshire boulevard as well as concrete posts. Specifications may be had from the city electrician.

The first electrically operated redwood lumber mill is that of the E. B. Salsig Lumber Company, at Gualala, Mendocino County, California, the electrical installation being made by the Allis-Chalmers Company.

The city council of Seattle has passed an ordinance transferring to the department of buildings the powers and duties of the city electrician relating to the installation, alteration and extension of electrical wiring and equipment.

The Bowie Switch Company of San Francisco has been advised that the U. S. Patent Office has granted its claims

for an air-break switch, including claims for magnetic horn blowout and follower contacts. These claims have been pending for eight years.

Blaine Grey and Alvin Sessions, formerly employed by Eardley Bros. at Salt Lake City, have recently resigned their positions with that firm to open up a business in the Keith Emporium to be known as the Keith Emporium Electric Company.

The Doerr-Mitchell Electric Company, Spokane, Washington, has the contract for 600 light brackets for the new Davenport hotel, these to be used in bureaus and dressers. The fixtures were designed by the company and are being manufactured in its local factory.

Eardley Bros. of Salt Lake City have recently obtained a contract for equipping the new Windsor Hotel which is being remodeled and refitted by A. Fred Wey, formerly manager of the Wilson Hotel. Special Brascolite fixtures will be used throughout the lobby, corridors, and public places of the hotel. The contract includes the installation of an animated electric sign.

The Independent Electric Company of Salt Lake City has been awarded contracts for electrical wiring in the high school building at Kamas, Utah, by contractors Mortenson & King; wiring of the new buildings to be erected at State and Exchange streets, by J. H. and H. E. Schraven; wiring of the garage building for the Continental Oil Company by contractors J. H. and H. E. Schraven.

The members of the Salt Lake City Lodge No. 357 of the International Brotherhood of Electrical Workers have voted to declare a strike in this city, but at the time of this writing the men have not quit work. The difficulty between the contractors and the electrical workers arises from the flat refusal of the ten electrical concerns of the city to recognize Mr. E. A. Wilcox as business agent of the union. The contractors say that while they have no difficulties or differences with their men they cannot stand for his methods. The electrical workers insist that this be done and unless some common ground can be located a strike will result.

W. H. Rogers, an expert in the power and mining department of the General Electric Company at Schenectady has been detailed by his company to make an investigation of the problem of electrifying the steam shovels of the Utah Copper Company, at Bingham, Utah. The steam shovel operations of this company are the largest in the world. An entire mountain of low grade copper ore is being eaten away by 30 to 40 monster steam shovels which are constantly in operation. The problem presented in the electrification of these steam shovels is an extremely difficult one, but President D. C. Jackling of the Utah Copper Company, who is also President of the Utah Power & Light Company, from whom the Utah Copper Company purchase their supply of power, is extremely anxious to see this electrification effected.

INCREASED P. P. I. E. FOREIGN PARTICIPATION.

Early in August, in response to inquiries from all parts of the globe, the management of the Panama-Pacific International Exposition announced that the exposition would not be postponed. The development of events since that time, in their relation to the exposition, all tends to confirm the wisdom of that original decision. When the decision was made no word had been received from any European nation as to what effect the European war would have upon its plans. In the last six weeks, however, it has become evident that many European nations will be represented at San Francisco.

So rapid has been the progress in the construction of the city of foreign government pavilions and palaces to the west and south of the Palace of Fine Arts during the first six weeks of the European war that each of them appears to be making an extra effort to surpass its neighbors. Of the

40 foreign governments which have committed themselves to participate, not one has withdrawn. On the contrary, many have applied for more exhibit space, and some have greatly increased their appropriations. Spain, France, Italy, Holland, Japan, China, Sweden and other nations in the war zone have officially notified the exposition that they will proceed with their buildings or exhibit despite the war.

The beautiful pavilions of Sweden, Bolivia, the Philippine Islands and Cuba are from 80 to 90 per cent completed. Those of Honduras and Canada—the latter a huge structure to be filled wholly with displays from Canada and moving picture halls—are finished. The German Kali Syndicate building, constructed in part by the German government, is more than half finished, as is the Holland pavilion, which is set in a large garden. The huge Chinese building, as well as the two mosque-like buildings of the Ottoman Empire, are nearly half completed. The three government buildings of Japan, to be set in a four-acre garden, are being built in Japan, to be sent "knocked down" and erected between the palaces of Cuba, Denmark and France, one of them being an ancient temple. Australia and New Zealand are rushing their buildings, which are over 25 per cent completed. The Chilean and Peruvian buildings will flank that of New Zealand, while Italy, Brazil and Argentina surround Turkey on three sides.

Within ten days after the war broke out Holland had increased its appropriation from \$100,000 to \$400,000 and ordered that construction be rushed upon the great Netherlands pavilion, immediately adjoining the Palace of Fine Arts.

The Persian display has been assembled at Teheran, and is ready for shipment. Spain, which had not decided to participate officially before the war, has since voted an initial fund of \$100,000 for participation.

England, Germany and Austria will be represented by individual exhibitors or by associations of exhibitors. Norway is proceeding actively with her plans, and Denmark broke ground for her pavilion the first week in September. The Argentine Republic, in view of the new trade alignments between the American continents, has increased its appropriation from \$1,250,000 to \$1,750,000; Italy has ordered construction rushed upon her great pavilion. Since the war broke out important publications in France have written the exposition for illustrations and data.

The Grand Duchy of Luxemburg, despite the war, has prepared and shipped a marvelous exhibit of unnamed roses to compete for the \$1000 prize for the Panama-Pacific International Exposition Rose. The Netherlands for its great government horticultural exhibit has asked for and has been granted 52,000 square feet of space, and the plants are being assembled in seven different cities in Holland, under the supervision of government experts. Japan has asked for 8000 additional square feet of exhibit space for her horticultural exhibit, making altogether in the competitive horticultural exhibit a total of 12,000 square feet. This is in addition to a four-acre garden. Japan will be represented upon a vast scale in all the exhibit palaces. Cuba has asked for additional space, and is making elaborate arrangements for her \$250,000 display.

France has cabled that her plans are unchanged. Aside from the action of the French Exposition Commission the athletic department of the Exposition has received word from France that there will be a representation in the athletic events.

Undoubtedly some of the entries on the athletic sports program will not be made and some of the art treasures intended for the Palace of Fine Arts will not be shown at San Francisco because of the war, but not by any means the majority, or the most important of them, and there are many factors in the situation which will more than compensate for these losses.

Since the war broke out there has been a very sharp increase in the demand for exhibit space from the manufacturers of the United States, South America and the European nations not at war.

While there is now no doubt that many European nations will be represented at the exposition, it is apparent that in addition there will be an unprecedented representation from South America and the Orient, as well as from Central America.

The exposition has become very important in an extraordinary economic situation. Manufacturers and exhibitors from South America and the Orient are preparing for a liberal representation. Cochin China, Indo China and Siam, the Philippines and many of the states of India and South Africa are beginning their preparations.

In regard to attendance, traffic managers are of the opinion that the European war is likely to increase travel to California in 1915 rather than to reduce it.

SOME ETHICS OF THE TELEPHONE.

A citizen called upon an attache of the Borough President's office a few days ago on a matter that was of great interest to him, says the New York Times. He found the official polite and eager to be of service, but the caller had no opportunity to discuss the matter in any detail and finally he left feeling that his call had been wasted. Complaining of the matter later the citizen said:

"The telephone bell at the official's right hand kept up an almost constant ringing. One man at the other end of the wire had scarcely ceased talking when some other man called up and so it went on until I came away. I went to my office and rang the official on the telephone and under the pretense that I had forgotten to mention a fact to him, had a very satisfactory talk. That taught me a lesson. In the future I will pay no man the courtesy of a call until after I have jarred his ear with the telephone."

A few days later, the subject, dubbed as the "Insolence of the Telephone," was discussed at a luncheon between several well known politicians and business men. Said one of the business men:

"I consider it just as rude to be interrupted by the telephone when I am engaged with a visitor as to be interrupted by a clerk. I never permit it. The young woman who presides over the switchboard in my office never calls me or any other member of the firm when we are talking to a visitor. She is kept informed as to the time we are engaged, and she always tells the telephone caller that another caller who has paid the firm the honor of a personal call is present and he will have to wait."

The writer, continues the account, was talking with one of the biggest lawyers in this city, and had been with him for nearly an hour discussing a matter of interest, when a young woman glided into the room and whispered to the lawyer. He turned to the caller and said:

"Please excuse me. My wife is on the telephone. She is the only one I permit to interrupt me when I am engaged."

Congratulated on his method of curbing the telephone, he said:

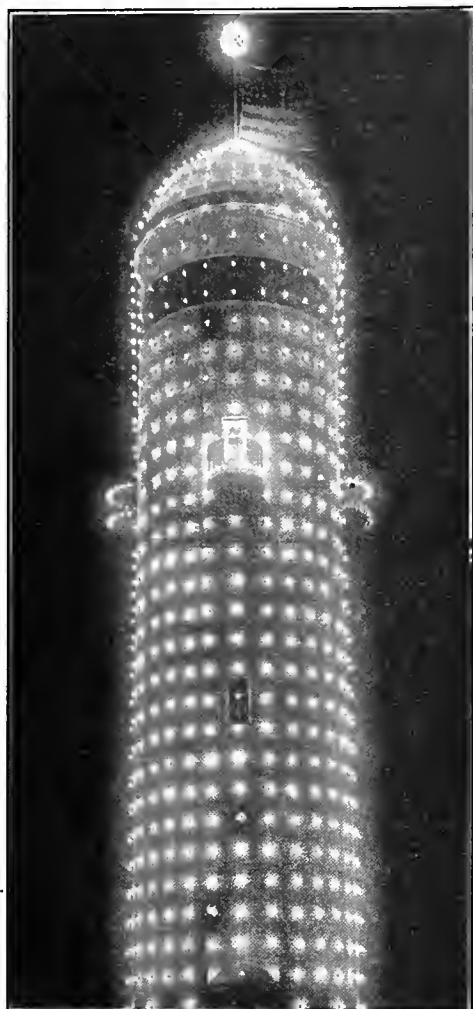
"The telephone has no respect for any person and no matter what a man may be doing its ringing breaks in upon him and jars his brain. I would not permit it to intrude upon me for any consideration. It must take its turn and if the man at the other end of the wire isn't satisfied with that situation, he can take his business somewhere else. The man who calls upon me is the man who comes first. I have known men who have called here and finding me busy have gone to a telephone near by and tried to get my ear that way. It used to succeed at one time, but that time has passed."



INDUSTRIAL



LIGHTING AT THE CALIFORNIA STATE FAIR.



The Tower of Light.

The Tower of Light, one of the many striking illuminated exhibits at the California State Fair. In this exhibit 1460 Mazda lamps were used.

EL RADIO, NEW LUMINOUS AIR HEATER.

A new luminous heater, known as El Radio, and of the glowing-coil-and-reflector type, is being manufactured by the Hotpoint Electric Heating Company of Ontario, California. This is not intended to take the place of a coal or wood stove or furnace, but serves for warming bathrooms, small offices and other small rooms, or in taking the chill off larger rooms.

The heater consumes 600 watts and can be attached to any lamp socket. It is equipped with cord, attachment plug and interchangeable switch plug, which can be used on other Hotpoint appliances.

This crescent shaped electric heater is formed of pressed steel, outside finished in polished nickel, with back of body in dull black, and the inside polished copper, lacquered to prevent tarnishing.

Its size at the feet is $9\frac{3}{4} \times 11\frac{1}{2}$ and the height over-all is 12 inches. A weight of only four pounds, and a wood handle at the top, make this little electric grate conveniently portable.

MAZDA EXHIBIT AT CALIFORNIA STATE FAIR.

One of the most striking exhibits maintained in the Manufacturers' section of the California State Fair at Sacramento, and one that strikingly conveyed to the spectators the thought with which it was designed is that which announced the message "Mazda Means Something." The display consisted of a reproduction of a Mazda lamp in its correct proportions, 17 feet high, surmounted by an attractive electric sign which carried the slogan "Mazda Means Something." The lamp figure and sign were studded with about one thousand all-frosted 10-watt Mazda sign lamps. The presence of this display made it unnecessary for the management of the Fair to provide any additional illumination for the entire center section of the large Manufacturers' tent.

In addition to the large lamp figure a number of racks were erected from which were suspended a number of Mazda lamps ranging from the 10 watt to 1000 watt sizes. The display was enclosed by an attractive lattice railing and presented a very striking appearance.

The Mazda exhibit at the State Fair was supplemented by window displays and newspaper advertising maintained by the electrical dealers and central stations in Sacramento. The moving picture theatres were also used to call the attention of the public to the message that "Mazda Means Something."

The co-operative plan for telling this message to the public is under the direction of the Mazda Bureau of the General Electric Company, San Francisco, of which Mr. H. H. Cudmore, who is well known in electrical circles, is director. The field work is carried on by Messrs. F. J. Blaschke, Clark Baker and A. B. Bond.

NEW CATALOGUES.

The Diesel Engine in the Brewery of the Anheuser-Busch Brewing Association, is the subject of an interesting pamphlet from the Busch-Sulzer Bros. Diesel Engine Company.

Western Electric Poles is the subject of an attractive pamphlet from the Western Electric Company which illustrates every detail of making a pole from the woods to the yard. Standard specifications for white and red cedar poles are included.

The Edison Lamp Works of General Electric Company has published several bulletins regarding the use of Edison Mazda lamps for different services. No. 43403 is concerned with store lighting, No. 43602 with series street lighting and No. 43404 with street car lighting. Each bulletin is essentially a text on its subject and contains many valuable and practical hints for the contractor and engineer as well as the central station solicitor.

The Bureau of Standards has just issued a new circular, No. 48, entitled Standard Methods of Gas Testing. The publication includes a detailed discussion of the various methods for determining the heating value, candle power, purity and pressure of gas and for testing gas meters which have been shown, either by careful investigation in the laboratories of the Bureau or by extended use elsewhere, to give results of sufficient accuracy to be regarded as standard.

"Silent Valve" Lighting and Charging Units—issued by The E. L. Russell Company, Indianapolis, Indiana, describes a generating set consisting of a high-speed rotary valve internal combustion engine direct connected to a generator. This company has issued a 28-page loose-leaf booklet disclosing in detail the construction of their new Rotary Valve for Internal Combustion Engines and various applications of same as related to Automobile, Marine, Stationary and other types.



NEWS NOTES



FINANCIAL.

PASADENA, CAL.—The city commissioners contemplate calling an election to vote bonds in the sum of \$290,000 for the improvement of the municipal water system.

BRAWLEY, CAL.—Bids are being received by the City Trustees for the purchase of \$35,000 in bonds voted for constructing municipal water works and a distributing system.

SEATTLE, WASH.—An ordinance has been passed ratifying and confirming a loan for the City of Seattle in the aggregate sum of \$400,000 for the purpose of enlarging and extending the municipal light plant of the city. The bonds will run twenty years, and bear $4\frac{1}{2}$ per cent interest.

GLENDORA, CAL.—Bonds in the sum of \$37,500 have been voted for the purchase of the present domestic water distribution system of this city, and to make improvements necessary to a complete municipal water plant. Bonds in the sum of \$25,000 were voted some six months ago, proceeds of which were applied to the purchase of water lands and the development of wells. A contract has been awarded the Layne-Bowler Company to test a well with view to installing a pumping plant.

SAN FRANCISCO.—The protective committee for the three-year 6 per cent collateral notes of the United Light and Power Company has been notified that the matured interest will not be paid within the 90 day default period. Under this condition, the note holders may take over the collateral consisting of the company's bonds. This company is a subsidiary of the United Properties Company. A letter from the protective committee ascribes the difficulties of the United Light and Power Company to the European situation.

TRANSPORTATION.

SAN FRANCISCO, CAL.—The contract to lay the street car tracks and sewer lines through the Stockton-street tunnel, from Sutter to Sacramento streets, was signed by Eaton & Smith Company.

SAN FRANCISCO, CAL.—The Church-street railroad will be a combined electric and cable line running over Church street without a curve. By a vote of 13 to 5 the Supervisors decided in favor of plan No. 7, offered by the Church-Street Railroad Non-Assessment League. Mayor Rolph says it will require ten days to study out some method of raising the money needed in addition to the bond money to finish the road. It will require about \$150,000.

FRESNO, CAL.—The Fresno Interurban Railroad is planning an extension of a mile and a quarter to a point within 400 feet of the Normal School. J. B. Rogers, who is promoting the building of these lines, has made application to the Supervisors for a franchise extending from Fresno avenue to the Normal School. Rights of way are now being secured and a portion of the bonus desired has been subscribed. The new line will represent an increased capitalization of about \$20,000.

FRESNO, CAL.—F. C. Webster, manager of the Fresno Traction Company, says that his company is ready to begin double-tracking Fresno avenue as soon as all franchise matters are cleared up according to city requirements. It is believed that the city will have all complications removed within three or four weeks. The construction work will last several weeks, as the old single track between Sylvia and Belmont avenues will have to be removed before the double tracks can be laid. The work will cost about \$50,000.

SAN FRANCISCO, CAL.—Specifications for the Municipal Railway's California-street line have been prepared by the City Engineer and adopted by the Board of Works, but as

this line would cost \$127,500 and the available balance remaining in the bond fund is only \$35,500, enough bonds to make up the difference will have to be sold before a contract for construction can be let. The sales of the \$3,500,000 issue already made total \$2,650,000, and the contracts so far awarded call for about \$2,615,000.

SAN FRANCISCO, CAL.—Detailed surveys and drawings of the proposed municipal street car line through Golden Gate Park have been completed by City Engineer O'Shaughnessy. Owing to obstructions it will be impossible to run the road in a straight line and to make it conform to the general surroundings the plan is to start in at Tenth avenue on the northern side of the park and come out at Fourteenth avenue on the southern side. Tenth avenue is the present terminus of a branch of the Geary-street road and this proposed extension it is believed will add a valuable feeder to the municipal line.

SAN FRANCISCO, CAL.—The Board of Works has filed a statement of the receipts and expenses of the Geary-street and Union-street municipal railway lines for the fiscal year that ended June 30. The gross receipts of the Geary-street line from July 1, 1913, to June 30, 1914, were \$642,450, and the operating expenses \$294,036. The obligatory charter charges and other reserves which had to be deducted were: Liability compensation from January 1, \$3386; depreciation, etc., 18 per cent of the gross, \$115,641; interest on bonds sold, $4\frac{1}{2}$ per cent, \$88,605. The true net profit was set down at \$140,281 after making these deductions, aggregating \$208,132.

OAKLAND, CAL.—At a special meeting of the directors of the Oakland Terminal Railways, W. A. Bissell resigned as president and director, and George K. Weeks succeeded him in the presidency. Mortimer Fleishhacker was elected to the vacant directorship. Mr. Weeks is head of the Pacific Coast department of N. W. Halsey & Co., whose clientele is interested in the \$2,500,000 issue of Oakland Railways collateral trust notes. Mr. Fleishhacker is president of the Anglo-California Trust Company, which handled \$1,100,000 Oakland Terminal collateral trust one-year notes. Mr. Weeks, in commenting upon his appointment, said that the change possesses no significance whatever from a financial standpoint, and that he is not taking the office as a representative of N. W. Halsey & Co., or as a representative of any particular class of security holders, but in the hope that, under the special circumstances existing at the present time he can render service which will be of value to the property as such.

ILLUMINATION.

LAS VEGAS, N. M.—Ornamental lamp posts are to be installed on grounds of New Mexico Normal University in immediate future.

MALTA, MONT.—A petition for a franchise for an electric light and power plant has been presented to the council by Shade & LeVesconte.

ASTORIA, ORE.—F. C. Harley of Astoria Harbor Improvement Company and others on Eleventh street, propose to establish "White Way" from the waterfront to Exchange street.

CENTRALIA, WASH.—The Crescent Oil Company has struck a flow of gas in drilling for oil near Tenino and will apply to the city commissioners for a franchise to furnish gas here.

PORTLAND, ORE.—Property owners on Fourth street from Jefferson to Burnside streets are contemplating installing a bracket lighting system.

YONCALLA, ORE.—An election will be held here in December to vote on the question of additional city indebtedness for the installation of an electric light system; estimated cost, \$6000.

SEATTLE, WASH.—Bids will be received until September 30th by Port of Seattle Commission, Central building, for installation of a lighting system division of Smith's cove improvement.

LOS ANGELES, CAL.—The city electrician has been instructed to prepare a scheme of electric illumination for the city hall, as part of a general plan of the Business Stability Association that all buildings on Broadway be illuminated at night.

SANTA ANA, CAL.—Sealed bids will be received up to October 13th by the Board of Supervisors of Orange County, Cal., for a franchise to lay and maintain a gas distributing system along public highways near Bay City, in Orange County, Cal.

SPOKANE, WASH.—A private gas plant for Whitworth College has been taken under consideration by the building committee of the college and R. L. Edmiston and D. R. McClure have been appointed to investigate the cost of installing such a plant.

TUCSON, ARIZ.—The Common Council of the city of Tucson is receiving bids for supplying electrical equipment for the completion of the city's ornamental lighting system. Detailed specifications and drawings are on file with the City Recorder of Tucson.

ABERDEEN, WASH.—L. H. Burnett and associates have made application to the Board of County Commissioners of Chehalis County for a franchise to lay and operate gas pipes and mains along the county highways. The application will be heard October 19.

MONTESANO, WASH.—L. H. Burnett and associates have applied to the board of county commissioners for a franchise to operate pipes and mains for the purpose of providing and conducting gas for public and private purposes on the public highways of the county. The Hearing is set for October 19th.

BAKER CITY, ORE.—The name of the Dry Gulch Ditch Company has been changed to the Dry Gulch Ditch and Electric Power Company. The company has a power site on upper Eagle creek, with a fall of about 200 ft., which will enable the company to use the water and then turn it back into irrigating ditches.

REDONDO, CAL.—A petition signed by city property owners of Hermosa Beach has been forwarded to County Supervisors, requesting that they sanction the establishment of a highway lighting district beginning at Manhattan Beach city limits and extending to city limits of Hermosa Beach, a distance of nearly two miles.

BAKER CITY, ORE.—The Eastern Oregon Light & Power Company has let a contract to E. A. Jerome to replace the plant which was burned in South Baker. The buildings will consist of the main structure 40x82½ ft., a fuel bin 18x24 ft., 30 ft. high, and 400 ft. of conveyor trestle 24 ft. high. The whole contract amounts to \$3000.

SAN MATEO, CAL.—By a vote of 33 to 11, the electors of the proposed Beresford highway lighting district decided in favor of incorporation. The election returns will be canvassed by the Supervisors, who will then proceed to declare the district incorporated. It is proposed to install ten lights along the main highway from the southerly limits of the Homestead to Beresford crossing.

NOGALES, ARIZ.—Spiro S. Proto, president of the International Gas Company, has received word that the Corporation Commission has granted the company the right to exercise the electric light franchise given them by the people of Nogales at a special election held last May. The gas company will now rush building plans as rapidly as possible, and is expected to have the plant in operation in about eight months.

MONROVIA, CAL.—The City Council has opened bids for the installation of a new street lighting system on Myrtle avenue. The lowest bidder was the Keystone Iron Works of Los Angeles, for \$6688. Other bidders were: W. A. McNally Company, Pasadena, \$7059; Woodhill-Hulse Company, Los Angeles, \$7000; M. J. McCune, Monrovia, \$10,424; Frank C. Farr, Los Angeles, \$9555; Newberry-Bendheim Electric Company, Los Angeles, \$7473; D. S. McEwan, Ocean Park, \$6800.

MARICOPA, CAL.—A big cut in the gas rate was offered to the consumers of Maricopa when the City Trustees met for the regular monthly business session, by the West Side Gas Company which serves the Midway with gas for fuel and lighting purposes. The letter from the president of the company to the Trustees stated that as the State Railroad Commission had cut the wholesale gas rate on which the company purchases the gas, the officials of the company were prepared to offer the Maricopa consumers a cut of 19 per cent over what has been charged up to the present time, if their offer should meet with the approval of the City Council and with the State Railroad Commission, which has the power to lower or raise any rate made by public service corporations.

TRANSMISSION.

BOISE, IDAHO.—Fifty feet of the Idaho Power & Light Company's flume on the Malad River was partially wrecked September 11th by a storm and power from the company's plant near Mountain Home was cut off. An auxiliary steam plant in Boise, together with help from the Idaho Railway Light & Power Company, saved the day. Ordinarily the Idaho Power & Light Company supplies the Idaho-Oregon Light & Power Company with a large amount of power. This supply was shut off, as was the supply of the railway company, which purchases about 1000 h.p. The Idaho-Oregon Company is not affected to any marked extent as the purchased power is used for irrigation service, which has been temporarily discontinued. The railway company discontinuing its irrigation service, and otherwise lightening its load, was able to serve the Idaho Power & Light Company, considerable power in return. Forty men are at work under the direction of manager E. P. Bacon repairing the damage done to the flume and the work will be completed in a short time. The flume is one mile long and carries 1000 cu. ft. per second.

TRANSPORTATION.

PORTLAND, ORE.—The council has granted a 25-year franchise to the Portland & Oregon City Electric Railway Company.

LYNDEN, WASH.—A franchise has been granted the Blaine-Lynden Interurban Company to operate over the city streets. Work to start before one year.

WENATCHEE, WASH.—Hyman Harris has been granted an extension of one year before beginning the construction of an electric railway in Chelan county between Malaga and Leavenworth.

VANCOUVER, B. C.—The B. C. Electric Railway Company will construct a line on South Cambie street from C to King Edward avenue, and thence to Main and Oak streets, the first of 1915.

TACOMA, WASH.—A contract for furnishing 118 tons of 70 lb. steel rails and 14 tons 91 lb. for the municipal car line has been awarded by Public Works Commissioner Woods to the U. S. Steel Products Company, the only bidder, for \$41 per ton for 70 lb. and \$52.45 for 91 lb.

SEATTLE, WASH.—A resolution has been introduced in the council offering to purchase the Seattle, Renton & Southern Railway and an ordinance, providing for the purchase of same. If voted by the council at the next meeting, the matter will be submitted to a vote on November 4th.

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Devoted to the Conversion, Transmission and Distribution of Energy

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P. P. I. E. ENGINEERING CONSTRUCTIONAL
FEATURES.

ELECTRICAL STANDARDS IN SAN DIEGO.
BY L. M. KLAUBER.

ELECTRICAL JOBBERS' MEETING.

CREATIVE SALES WORK BY JOBBERS.
BY T. E. BURGER.

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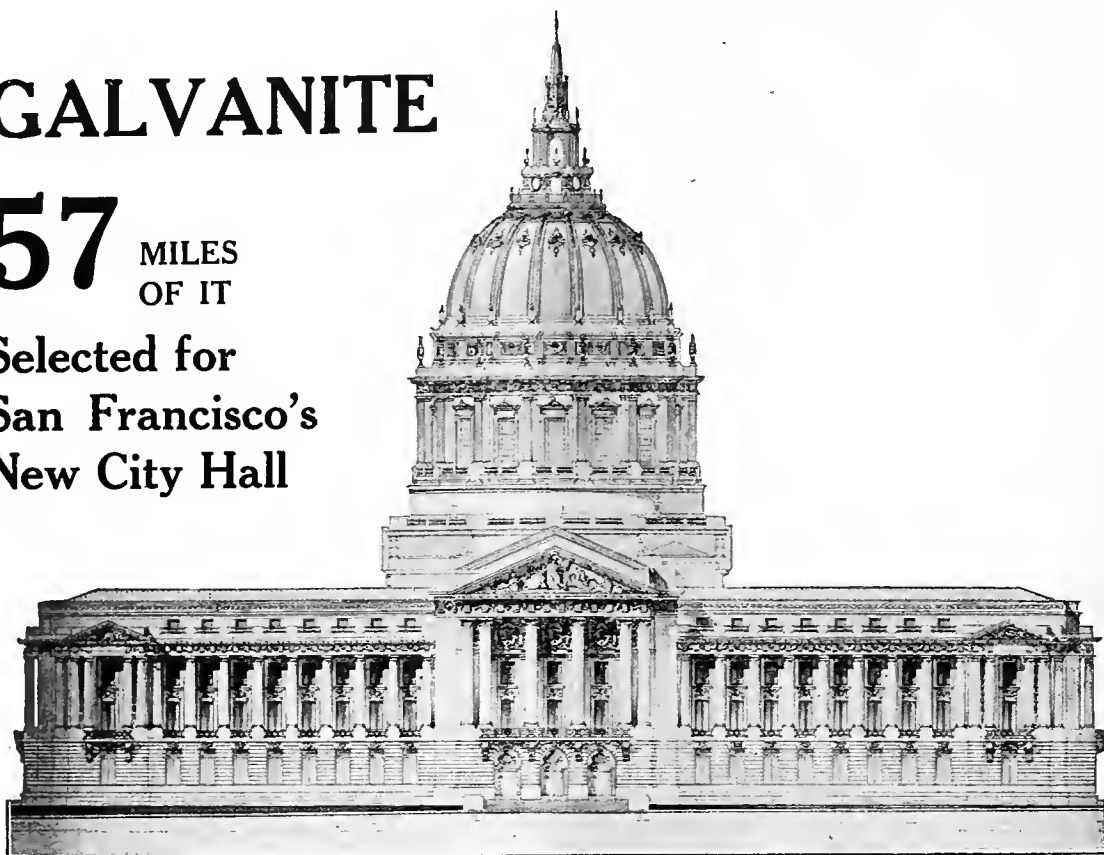
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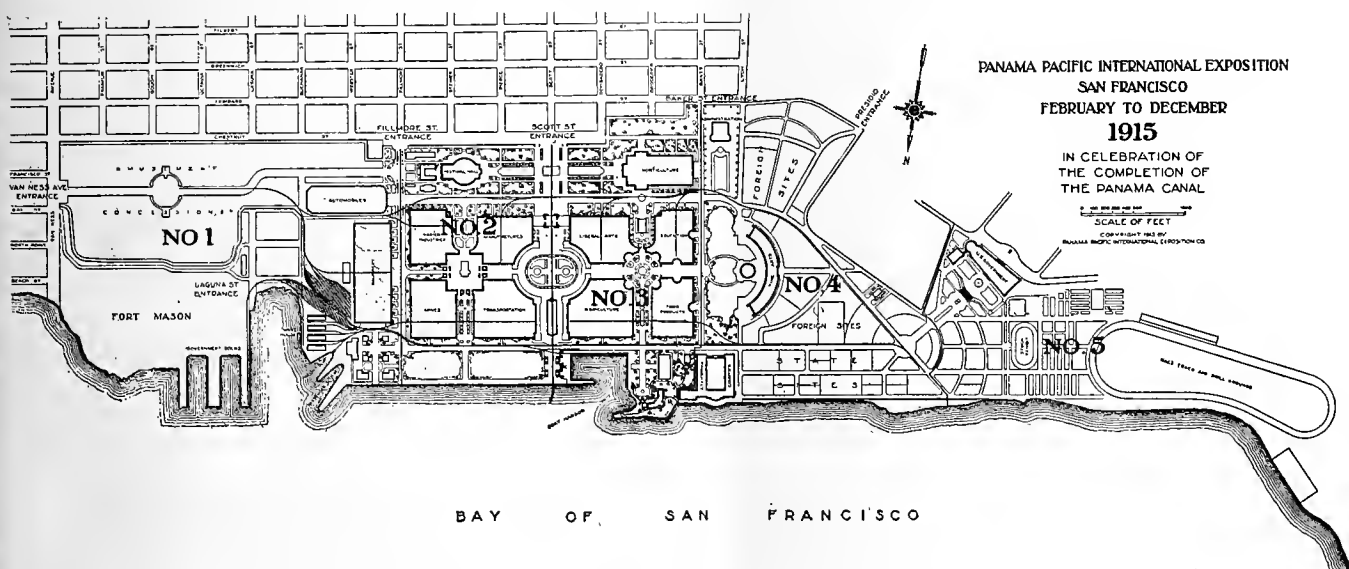
NUMBER 14

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P. P. I. E. ENGINEERING CONSTRUCTIONAL FEATURES

From an engineering standpoint an exposition may be said to have three periods—the constructional, the instructional and ultimately the destructional. The constructional period of the Panama-Pacific International Exposition is almost completed. The instructional will begin when the Exposition is opened at

The celerity with which this construction has progressed, now being practically finished months before the actual opening of the Exposition, is largely to the credit of the Department of Works, a most remarkable engineering organization under the supervision of the Director of Works, Mr. H. D. Connick.



General Plan of Panama-Pacific International Exposition.

San Francisco on February 20, 1915, and the regrettable, but inevitable destructional will commence after the Exposition closes in December of that year.

The constructional period has been essentially a time of supplying utilities for a great city, the "City of Dreams" which engineering genius has made a living reality. Here the dreams of architects, sculptors, artists and inventors have been materialized. But greater than the artists' touch and loftier than the architects' towers stands forth the noble purpose of this mighty world movement for the building of a tomorrow, the coronation of service.

The utilities to be supplied in a few brief months were those that other modern cities have been years in acquiring, roads, buildings, sewers, fire-protection, water, gas, electricity, transportation, steam and compressed air service.

The Division of Works is composed of seven departments, each made up of the necessary number of bureaus, designated in alphabetical order. The departments and bureaus are briefly as follows:

The Department of Construction has charge of all structural matters and construction, contracts and estimates, and is in charge of the Assistant Director of Works, A. H. Markwart. The following bureaus cover the work in this department: (A) Structural Engineering; (B) Building Construction; (C) Specifications; (D) Estimates; (E) Memorandum Accounts; (F) Lands; (G) Medical.

The Department of Civil Engineering is concerned with the filling and grading of the Exposition site, the design and construction of railways, roads, sewers and water supply, and the supervision of all surveying and day labor. The following are the bureaus: (H)

Engineering Construction; (I) Water Supply and Fire Protection; (J) Railways.

The Department of Mechanical and Electrical Engineering has supervision of power and light distribution and has one bureau: (K) Illumination.

The Department of Architecture handles all matters relating to architecture, with one bureau: (L) Design.

The Department of Landscape Engineering is concerned with general landscape design, moving and transporting of trees and the planning of lawns and horticultural features.

Two other departments, Color and Decoration, and Sculpture, complete the list.

A Picturesque Exposition Site.

No site could have been selected that offered greater advantages for displaying constructional features, or that could be made more picturesque than that upon which the Exposition is built. Fronting on

The Machinery Hall is set to the east, Fine Arts to the west, and Horticultural and Festival Halls to the south of the group.

The Zone, containing the amusement concessions, is at the east end of the grounds and the state and foreign buildings at the west.

Dimensions and Costs of Buildings.

Buildings.	Size ft.	Area Sq. ft.	Volume 1000 cu. ft.	Total Cost.
Agriculture	579x639	328,633	20,634	\$425,610
Education	394x526	205,100	14,053	304,263
Festival Hall	276x386			270,000
Fine Arts		126,000		580,000
Food Products	424x579	236,690	15,609	342,551
Horticulture	300x660	195,000		341,000
Liberal Arts	475x585	251,300	16,038	344,180
Machinery	367x967	369,600	38,000	659,665
Manufactures	475x552	234,000	15,650	341,069
Mines and Metallurgy..	451x579	252,000	16,199	359,445
Transportation	579x614	314,000	20,413	481,677
Varied Industries.....	414x541	219,000	14,648	312,691
				\$4,762,151

Foundation Footings.

A large portion of the site is filled ground underlain with clay and blue mud, green sand and clay, and



Panoramic View of Panama-

San Francisco Bay for a distance of two miles, and just inside the Golden Gate, the Exposition site offers a beautiful perspective that would be hard to improve. On the three other sides the grounds are surrounded by picturesque hills, the whole constituting a vast natural amphitheater whose 625 acres are distributed as follows:

	Acres.
Concession district	69.2
Railway yards, wharves and docks	17.1
Exhibit palace site proper.....	217.3
Street railway terminals.....	2.3
State pavilion sites	42.3
Foreign pavilion sites.....	49.7
Aviation field drill grounds and racetrack.....	37.7
Livestock section	24.3
Life saving station	1.1
Proposed U. S. Government exhibit	12.7
Unappropriated at westerly end.....	10.3

Total area for definite purposes..... 484.0

The exhibit palaces occupy the central portion of the site. The main group consists of the following: Education and Social Economy, Food Products, Agriculture, Liberal Arts, Manufactures, Transportation, Mines and Metallurgy and Varied Industries. These are grouped about the Grand Court of Honor, 500x900 ft. in size. The great Tower of Jewels, 435 ft. in height, adorns the central front of the group and forms the centerpiece of the Exposition architecture. The main buildings are separated by open spaces not exceeding 150 ft. This is an economic feature not adopted at previous expositions, where the spacing ran from 300 to 400 ft.

hardpan, the latter varying in depth from 30 to 120 feet. The soil under the area not filled in is yellow beach sand, soft clay and sand, hard green sand and clay, and yellow hardpan.

As the surface showed only a supporting strength of 400 pounds per sq. ft., prohibiting the general use of spread footings, pile footings were decided on as support for all the buildings so as to give uniformity of construction, greater safety in case of earthquake and economy of cost.

The piles were from 16 to 75 ft. in length and were driven to a penetration of one inch at the last blow of the driver, each pile being assumed to carry a load of 20 tons.

The floors in the buildings are supported independently of the walls. Live loads on floors are estimated at 100 lb. per sq. ft. in all the main group of exhibit palaces with the exception of Mines and Metallurgy, which is 150 lb. and Festival Hall, where the floor loads are estimated at 125 lb. The assumed weights are 3 lb. per board foot for lumber, 5 lb. per sq. ft. for plaster composition and 20 lb. per sq. ft. or 100 lb. per cu. ft., for cast composition.

Types of Construction.

The standard method of construction, unless a steel frame is used, is a timber frame carrying a wall built of wooden studs and covered with sheathing and a special composition in imitation of marble. The ex-

terior walls are covered with a composition of specially prepared gypsum, colored at the factory according to formulas furnished by the Exposition company. Where cast forms are not used, plastic composition is applied direct to the grooved sheathing.

The roofs consist of 1 in. dressed ship lap supported on roof joists or rafters and purlins. The covering is a prepared roofing with an asbestos top sheet, cemented to a layer of roofing felt. The surface is covered with a fire retarding paint in colors to correspond with the general color scheme. This style of roofing affords greater protection from fire than plans followed at previous expositions. Skylights will utilize 20 per cent of roof surface and are glazed with ribbed wire-glass.

The 60 acres of gardens, with their brilliant color display afforded by many flowering shrubs and plants, have required 50,000 cu. yds of loam and 16,000 cu. yds. of fertilizer.

chief source of supply through the 20 in. Van Ness avenue main of the San Francisco auxiliary high pressure water system. There is also a 12 in. connection at Fillmore street and two manifolds on the water front for fire-boat connection.

Over 15,000 ft. of 16 in. mains were installed, while the sub-mains and branches consisted of 14,000 ft. of 12 in. mains, 10,000 ft. of 10 in. and 13,000 of 8 in. This represented a weight of 850 tons of wrought iron pipe, about 60 tons of Dresser couplings, 75 tons of extra heavy cast iron fittings and 60 tons of extra heavy flange gate valves.

It was necessary to set 192 double hydrants in concrete manholes, a hydrant being placed about every 300 ft. on the line throughout the system. Each main exhibit palace was supplied through four 8 in. branches.

The installation of this system was accomplished in six months' time, the crew averaging 120 men,



Pacific International Exposition.

The maximum demand for fresh water has been estimated at 3,500,000 gallons a day but a rate of flow has been designed one and a half times as great, to guard against any contingency which may arise. A booster pumping station will assist in keeping a proper pressure and a reservoir of 500,000 gallons in the Presidio provides an auxiliary supply.

The distribution system comprises 4, 6, 8, 10 and 12 in. mains paralleling the high pressure water supply system, so that secondary and primary fire protection will be available in all parts of the districts covered with buildings. All main exhibit palaces will be connected to the domestic water supply system by means of 6 in. pipes on each side of the building, and each building will be supplied with water for domestic service, and to which will be attached low pressure standpipes and small hose equipment.

High Pressure Fire Protection System.

The primary high-pressure system is available in the concessions district, main exhibit palaces and the state and foreign districts. An automatic sprinkler system is used in the buildings of the main group. There are also open cornice sprinklers for creating a water curtain on the fronts of the buildings.

Especial engineering interest is attached to the methods by which this system was installed by the contractors, The Turner Company of San Francisco. As may be noted from the accompanying ground plan the system is laid out as a loop of 16 in. pipe with

engaged in excavating, refilling, building the necessary cribbing, putting in concrete blocks for valves and fittings at the turns, as well as handling and laying the pipe. On account of the heavy pressure, 450 lb. being maintained for one hour in each section as laid, especial provision had to be made for blocking the turns, a concrete form with a 6 ft. backing frequently being necessary.

The Turner Company also installed the sprinkler system, which is believed to be one of the largest single installations in the world, over 54,000 sprinkler heads having been used for the main group of eight buildings. There were 65 miles of 6 in. to $\frac{3}{4}$ in. pipe required and 650 tons of fittings, black extra heavy malleable being used for the five and six inch, and galvanized banded malleable for the 4 in., and smaller.

The first riser was put in on April 13th, and the contract was completed on September 15th, the crew averaging 100 men, including the superintendent and two foremen, as well as two draughtsmen preparing the working drawings. All pipe was cut from the drawings, five pipe machines being necessary during the progress of the job. On account of the exceedingly low bid, and the necessary time limit, great credit is due to the Turner Company for the manner in which they fulfilled their contract.

The system is capable of supplying 15,000 gal. per minute over an area of 100,000 sq. ft. under a run-

ning pressure of 200 lb. per sq. in. All buildings are at least 130 ft. apart, excepting where joined by courts, in which case, a reinforced concrete fire wall is interposed. Every building is completely equipped with chemical hand extinguishers and 6 chemical engines. Three complete fire stations with latest motor driven apparatus are situated at strategic points, and a complete electrical fire alarm system has been installed, and now constitutes the first working electrical exhibit.

Paving and Transportation.

There are 4,000,000 square feet of pavement and 700,000 square feet in the formal courts and entrances. The paving is colored, as required by the general color scheme, the macadam roads being composed of red radiolarian chert. The concrete surfacings are colored.

The avenues are from 50 to 80 ft. wide and the paths, 10 to 15 ft. wide. Of the road area, 16 per cent is located over the hydraulic fill but not much settlement is expected, as a concrete base is used.

There are 10 miles of standard gauge track in and about the grounds and terminal warehouses. The tunnel under Fort Mason gives physical connection with the belt railway system and railroad cars can be brought direct into the grounds without having to be loaded on the freight ferries. The freight ferries however will play an important part where lines have their terminals in Oakland, Richmond and Sausalito, as the cars can be landed at the grounds by means of the ferry slips.

A direct passenger ferry system will be maintained between Oakland and the grounds.

In Transportation Palace fifteen tracks, each 500 ft. long, have been built for exhibitors' uses.

No intramural system for carrying passengers about the grounds will be installed, some other form of transportation being used.

Combined Storm Water and Sewer System.

A combined system for collection and disposal of storm waters and sewage is in use in the exhibit buildings and concessions district. The storm waters from the 63 acres of roofs will be carried by sheet metal down-spouts direct to the sewers. There is sufficient slope to the ground in the state and foreign districts to give natural run-offs.

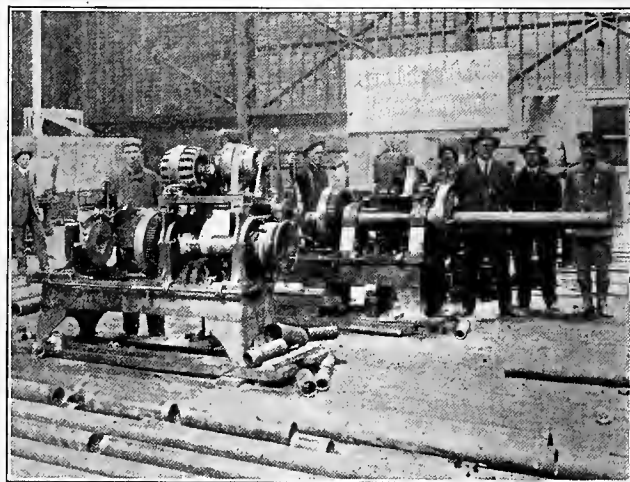
Saturated steam is to be supplied from the Fuels Building, at 150 lb. pressure through a system of steam mains from boilers having a rated capacity of 1500 h.p. Compressed air at 80 lb. pressure will be available.

Electric Power.

Power is supplied to the main transformer station east of Machinery Hall at 11,000 volts by the Pacific Gas & Electric Company. It is distributed from a primary distribution system; 3-phase 4150 volts a.c., with grounded neutral. As overhead construction was not feasible for the greater part of the grounds it was decided to use an underground conduit system, consisting of Orangeburg fibre linaduct installed in wooden box construction. The concessions section required 1300 trench feet of conduit, the Exhibit Buildings section 2500 ft. and the state and foreign site section, 10,000. Where necessary, the manholes

are of concrete, but in many instances they are constructed of timber. The average cost of installing 3 in. duct in wooden box construction was 14 cents per duct ft., including the wooden manholes which were placed at an average of 350 ft. apart. About 100,000 ft. of power cable is to be installed, over 60 per cent now being in place. Most of this cable is 3-phase, 4/0, 11,000 volt, sector type, and the cost of pulling, with the gasoline engine rig employed averages 3c per foot. The cost of splicing this 4/0 sector cable averages \$6.33 for labor and \$6.35 for material, for each splice made. Where there are a number of splices to be made in one manhole, the cost per splice is somewhat less.

Overhead construction is employed back of the concessions district and in the extreme western part of the grounds.



Pipe Cutting Shop.

Three-phase current is distributed for lighting and power requirements in the main palaces by means of four wire circuits with 115 volts between conductors and neutral. In other parts of the grounds single-phase is supplied by three-wire mains at 115 or 230 volts. Direct current at 125 and 250 volts is available in the Machinery, Mines, Transportation and Manufacturers' palaces.

It is estimated that the average night peak will be 8500 kw., conductors being designed for a maximum of 11,500 kw. to meet the contingency of simultaneous day motor load and ground lighting on dark days.

Gas.

Gas for both heating and secondary lighting is supplied at 30 lb. pressure through a system of high pressure mains, consisting of 8 in. and 4 in. loops encircling the ground. Crude oil gas is supplied from one of the plants of the Pacific Gas & Electric Company, which adjoins the Exposition. High pressure gas arcs are to be used for all emergency ground lighting throughout the Exposition. A complete suspension of electric power would leave the grounds well lighted, and gas will also be used for patrol purposes after closing hours.

Illumination.

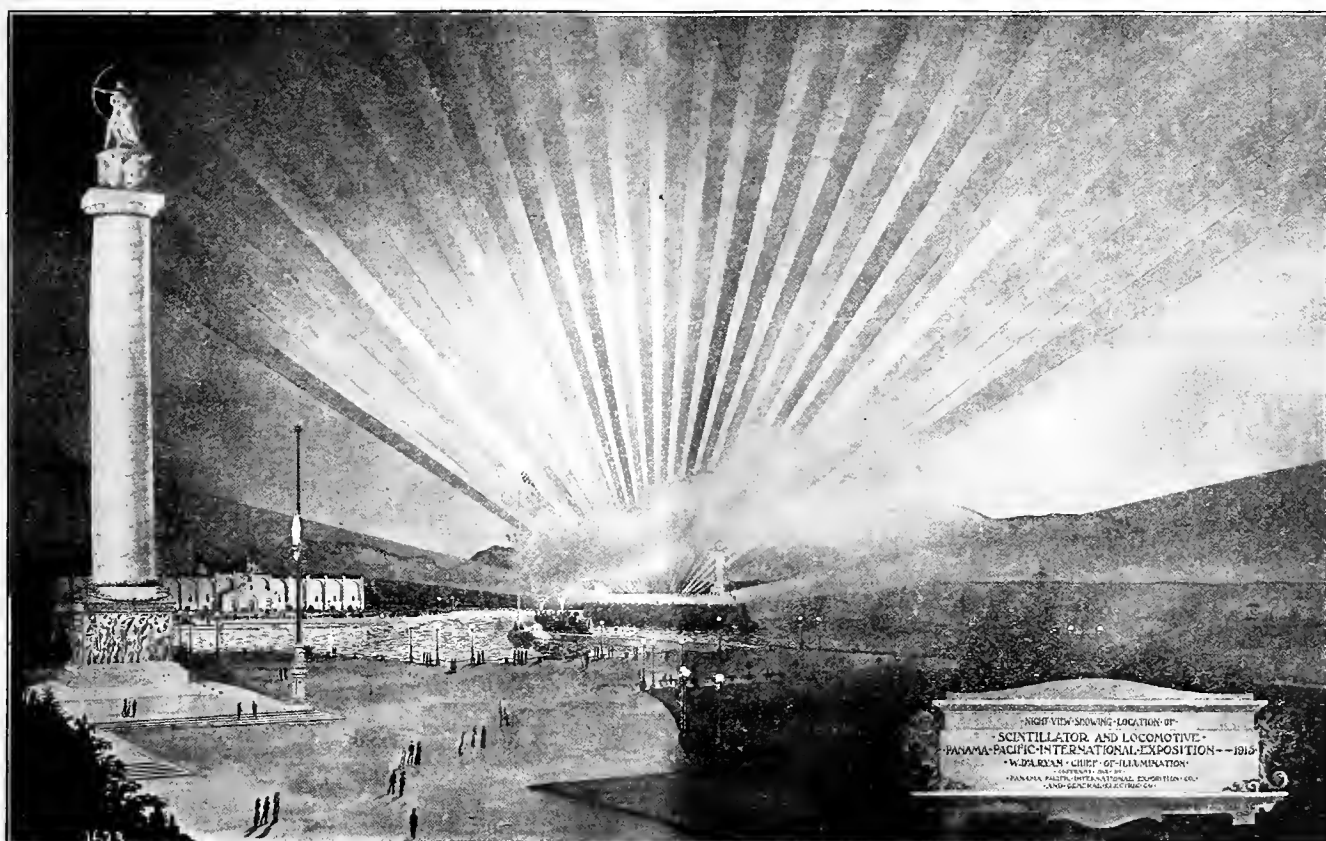
The main illumination, however, is to be electrical. All the lighting of the grounds is by the in-

direct flooding system from concealed sources, and nitrogen filled lamps will be mounted on huge standards 10 to 30 ft. high, placed along the walks facing each building, and shielded by banners on all sides except that opposite the facades of the palaces. These standards are constructed of plaster, and make a beautiful ornamental feature by day as well as a useful one by night.

There will be no outline lighting of the buildings, with its consequent glare. The chief architectural lines and ornamentations on the palaces will be emphasized by various colored jewels hung so as to constantly vibrate in the light. A battery of forty-eight 36 in. searchlight projectors is being mounted on a tower perched on an outjutting point in the bay. These will throw intense rays of light through color diffusers, which will separate the flood into fan-shaped rays with all the colors of the spectrum. These rays will be thrown on to the jewelled walls of the palaces, so that they will glow with multi-colored fire. In lieu of the usual fireworks the scintil-

The central feature of the night illumination is the Tower of Jewels. Rising in terraces to a height of 435 ft., decorated with statuary and bespangled with myriads of jewels, it is a notable conception and adds greatly to the effectiveness of the illumination scheme. Sixteen projectors have been erected over the Scott street entrance, just opposite the Tower, and largely for illuminating its front. They are equipped with diverging doors, made up of convex lenses, at such angles as to illuminate only the object aimed at and thus have no waste light. Projectors on the roofs of the Liberal Arts, Agriculture, Transportation and Manufacturers buildings light the other sides of the Tower.

The most noteworthy groups of statuary of the Exposition have been erected over the Arch of the Rising Sun and the Arch of the Setting Sun, situated at the east and west entrances of the Grand Court of Honor. The arches will be lighted by incandescents concealed in the cornice. The statuary will be illuminated by colored lights from projectors and concealed



Searchlight Scintillators for Spectacular Lighting.

lators will play upon open jets of steam forced through set pieces of pipe which will be caused to assume strange and weird forms by means of a system of valves. A new and convenient form of decorative lamp receptacle has also been developed by the department for all festival lighting. Flat insulated cable will be festooned as needed, and these receptacles clamped so as to make contact wherever desired. Special lamps imitating fruits and flowers may thus be used.

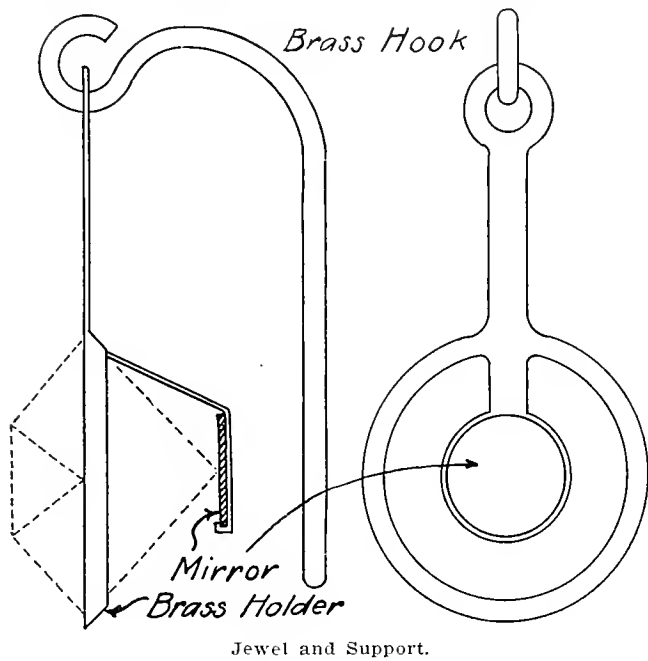
The main exhibit palaces are not to be open after dark, and are equipped only with sufficient lamps to care for janitor service. Lights will also be placed back of the windows so as to add to the luminous effect.

incandescents will be used for relief of shadows about the groups.

In general all statuary will be lighted from two directions, one a strong clear light and a weaker colored one from another, to make a luminous shadow. This idea will give definite depth to an object and bring out clearly the modeling and decorations. Relief lighting will be accomplished by incandescents placed at the base.

Windows over the entrances to all the buildings will be painted glass and the clerestory windows of Deflex glass. Suspended colored incandescent lamps with reflectors and hung ten to fifteen feet back of the windows furnish night illumination.

A moonlight effect will be given the front of Fine Arts building. Four stations equipped with projectors are erected on the west end of the roofs of the Education and Food Products buildings. The projectors are equipped with color screens and diverging



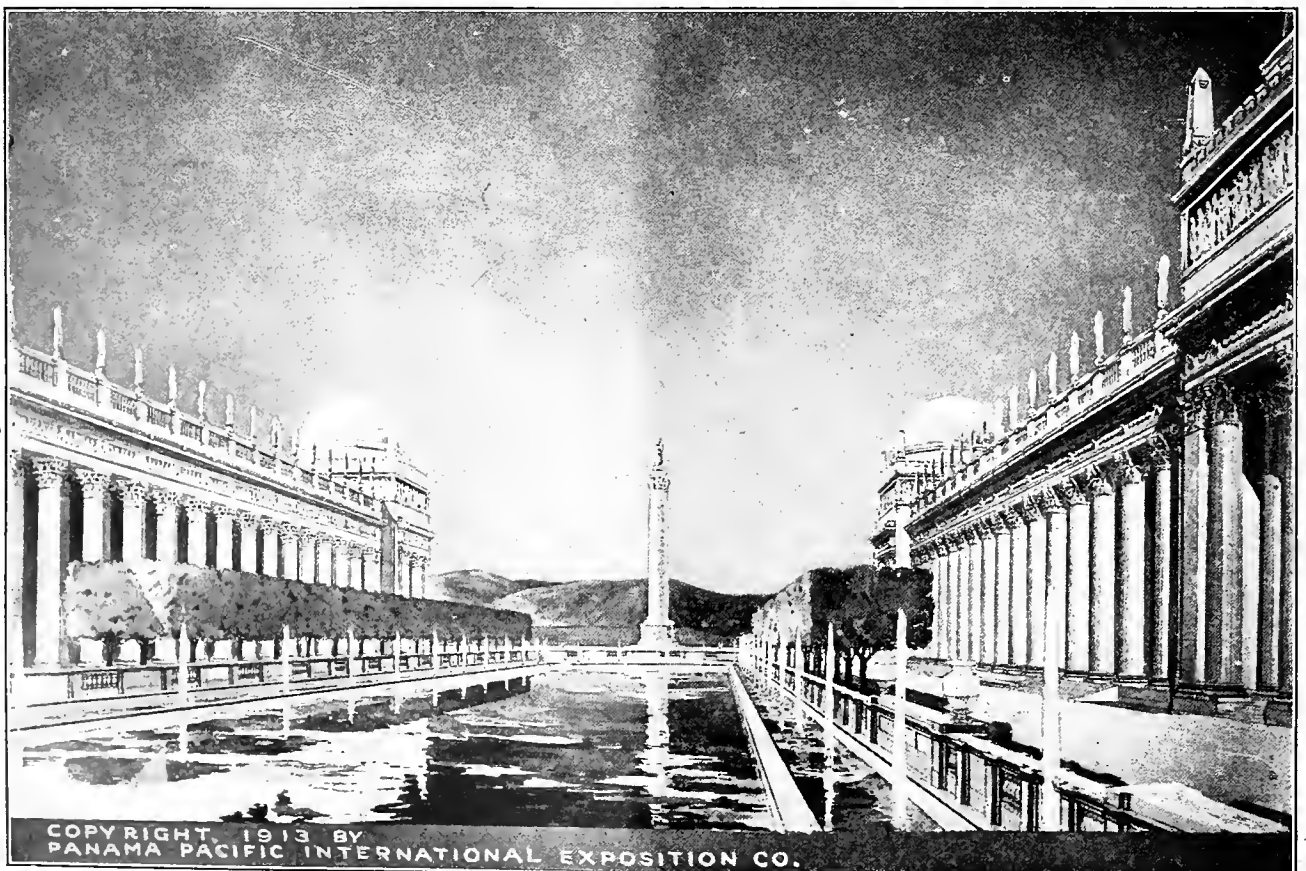
doors. A colonnade 60 feet wide and adorned with statuary runs the entire front of the building and with the lagoon in front should make a beautiful setting for such a scene as will be portrayed.

Lighting of the various courts is largely accomplished by the use of nitrogen lamps mounted on decorative standards. In the Court of the Universe two fluted columns, 38 ft. high and 5 ft. in diameter, of diffusing glass and equipped with high power nitrogen lamps, set at either end of the sunken garden, form the main illumination. This court is surrounded by a classic colonnade with 50 ft. columns surmounted by figures symbolical of the stars. These 110 figures stand 14 ft. high, and the head of each is crowned with a star measuring 4 ft. across and covered with jewels, which will scintillate in the beams crossing the court from projectors in the base of each column.

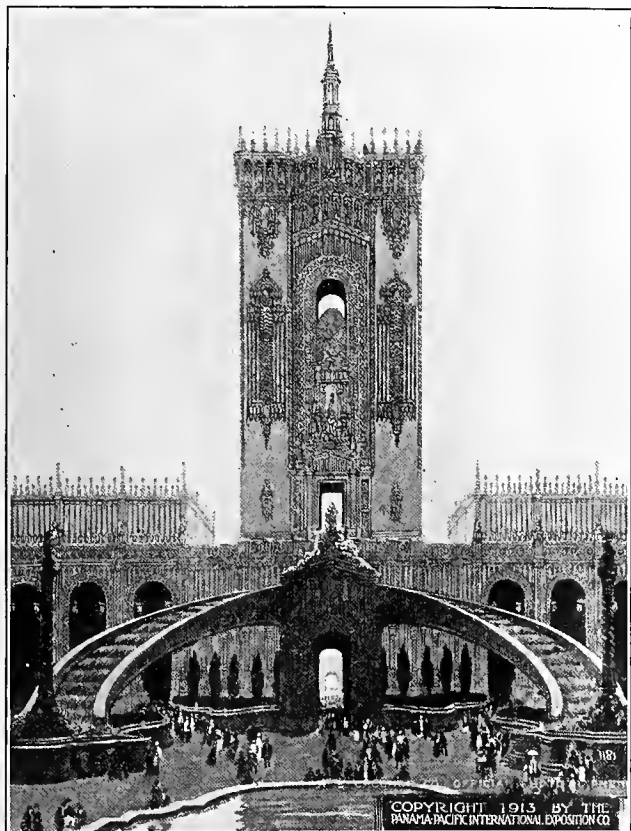
The Court of Abundance, which symbolizes the creation and development of the earth and man from the earliest forms of unicellular life to the latter day higher planes, will also contain a great central basin, at one end of which will be an 18 ft. illuminated glass globe, representing the earth turning on its axis, in the midst of slowly rising columns of steam, and at the opposite end a great disc of glass represents the sun setting at the water's edge. Huge gas flambeaus will surround the central lagoon and line the fireproof walls, along which will be placed columns supporting huge heroic figures of prehistoric men.

The Court of the Four Seasons will be lighted by luminous arcs placed on standards. The great South Garden is lighted by two rows of luminous standards, 55 ft. high which will flank the central fountain.

Ornamental gas standards 35 ft. high with 100 ft. spacings and in symmetrical locations are used in the Zone, the amusement concession area. These are surmounted by Oriental decorations. At a height

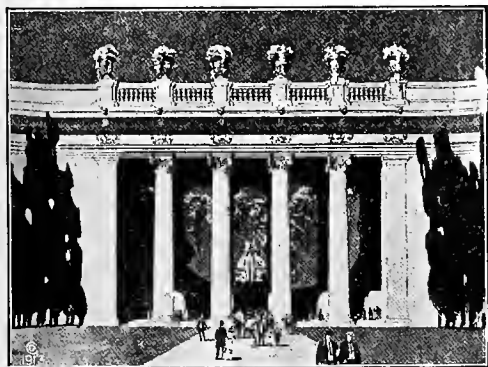


Court of the Universe.



Cascades of Court of Abundance.

of 15 ft. two lanterns are suspended from projecting arms and containing gas lamps. Strings of small lighted Mission bells hung from tree to tree along the avenues of palms will give a festive appearance to the promenades.



Court of Four Seasons.

In the Education, Social Economy, Liberal Arts, Manufactures and Varied Industries, Machinery, Transportation, Agriculture, Food Products and Mines and Metallurgy palaces which present plans contemplate will be closed at night, the scheme calls for illumination of the aisles by means of a trough lined with mirrored reflectors placed in the trusses and by conventional fixtures where necessary.

In the California building the foyer is lighted by electric candles. The ball room which has a flat ceiling will be lighted by a bamboo frame, silk covered ball using tungsten lamps. In the President's dining room is a square skylight with a silken sheet hung beneath it and the light filters through from above. All the lighting fixtures are in Mission style.

Festival Hall, which will be used for concerts and festivals, will be lighted by a unique, indirect scheme. A diffusing disc set over a pit in the floor collects the rays from ten projectors placed in the pit, and diffuses the light throughout the auditorium, aided by reflection from the dome which covers the auditorium. The pit is surrounded by a parapet wall about four feet high and it is so set in the aperture that light will be directed from its surface to every portion of the dome. Conical mirrors are also set around and above the disc to catch any stray rays of light. By using colored screens over the lenses of the searchlights vari-colored lighting effects may be easily secured.

The heat generated will be removed by a blast of cold air from the generating system. A stream of water constantly running over the lens of each of the searchlights aids in the cooling. The diffusing disc will be cooled sufficiently by air circulation.

While the lighting of the auditorium is entirely taken care of by this method, yet suspended fixtures are used in some of the alcoves. The balconies and foyer are lighted by such fixtures. These serve the double purpose of illumination and decoration.

The footlights on the stage consist of 210 clear lamps and 70 each of amber, blue and red, with a 100-step dimming attachment. A complete portable system is provided by sixteen 300-watt stage pockets. The conference rooms and offices are lighted by small semi-indirect units made from staff.

Relief lighting for the cupola above the main dome is accomplished by installing 250 watt units on each story, placed one foot above the floor. The relief lighting for the pavilion towers has eight 250 watt units placed in the upper portion of each.

The total connected load exclusive of motors amounts to 106 kilowatts.

The average requirements of lighting in buildings closed at night, for janitor and patrol service, are figured on the basis of 1/10th watt per square foot of building area.

All exhibitors in the Machinery, Transportation, Manufactures and Mines and Metallurgy buildings, will light their own exhibits along lines which must meet with approval of the Department of Works.

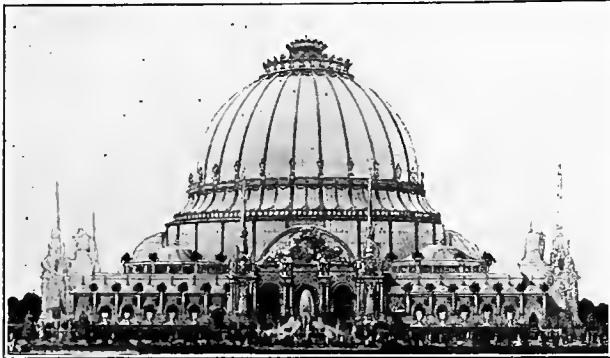
Horticultural Hall covers an area of more than five acres. The main building is 672 ft. long and 320 ft. wide in its largest dimensions. Towering above the front portion of the building an immense dome of glass and steel reaches to a height of 186 ft. and has a diameter of 154 ft. at the base. Four smaller domes and a number of lofty spires grouped about the main dome give a beautiful decorative touch to the architectural scheme.

Interior artificial illumination in the daytime is not an essential feature, owing to the large amount of glass used in the construction of the building, admitting the sunlight. Eight semi-domes flank the main dome. The interiors of these semi-domes are provided with electric lighting fixtures which supply the necessary light upon occasion and add to the architectural design. Ordinary electrical methods are employed for auxiliary lighting of the exhibits.

A tower of fifteen feet high, as a base and support for the special illuminating appliances, is erected

in the central interior of the main area. It is surrounded by tall coconut palm trees, concealing the electrical mechanism from view.

At the top of this tower is a glass lens plate set horizontally, five feet in diameter, $\frac{1}{4}$ in. thick and divided into quadrants. Each quadrant is a composite lens, made up of a number of small circular lenses cemented in the surface of the plate. The small lenses are each capable of projecting rays to all parts of the dome. Five different sets of composite lenses have been designed, each having a special lighting function. There are four of each set, making five complete lens plates.



A circular color screen is placed beneath the lens plate and in a parallel plane. It is slightly larger in diameter than the plate. The screen is made up of six equal-sized colored plates, there being three colors used and two plates of each color. The main scheme uses the colors yellow, blue and red, three primary colors, in that sequence and repeated, the two plates of each color appearing opposite each other.

Under the color screen is a circular sectored disc of the same diameter as the screen and consisting of four portions. Two of the portions are of opaque glass and double the size of the other two which are apertures, making the apertures of the same size as the plates in the color screen.

The color screen and the disc are mounted on a vertical rotating shaft, composed of two parts so that the screen is attached to one part and the disc to the other. The screen and disc rotate at varying rates of speed, so designed that the disc makes one more revolution per minute than the screen.

The rotating mechanism is operated by an electric motor, geared down to a ratio of twenty to one, that is, twenty revolutions of the motor will give one of the screen.

Twelve 30 in. electric projectors of 25,000,000 candlepower each, are arranged in a circle about the tower and set to throw their light upward through the color screen, the light first passing through the apertures in the disc. As the disc rotates through the flood of light cast by the projectors, the screen is also moving in the same direction, though at a slightly less rate of speed, and the light coming through the apertures filters through the color screen and up to the lens plate and is colored in the process.

It is easily understood that when the position of the aperture coincides with one of the color plates, a ray of that color will ensue, but as the disc in its slightly

accelerated rate of speed begins to throw light into the next plate so that a color different from the other two will be formed and then fade into the color of the next plate. As the blue plate begins to encroach upon the field of the yellow, a greenish tinge in the rays will appear, expanding into a green light when both plates are equally over the aperture. As the screen rotates we find them, first the yellow rays, then the green formed by the blending of the yellow and the blue, then the blue, then purple as the blue and red mingle, then red, then orange as a combination of the red and yellow, then the cycle of colors is completed. Six colors have been thrown upward through the lens plate in the space of a minute, together with the various shades of intermediary light.

A combination of three lenses will also be used over the screen, and so arranged that only one at a time will be in position over this screen. One will be plain, one will produce spots of light, and the third will present an appearance of millions of tiny tadpoles squirming about the interior of the dome.

The Palace of Fine Arts lighting effects will be conducive to quiet and peace. This is the only permanent palace on the grounds, being constructed of reinforced concrete and steel.

An electrical farm is attracting attention in the agricultural department of the Exhibition at Christiania. The energy for this model farm is supposed to come from a small waterfall in the neighborhood. The visitor is first of all struck by the splendid appearance of the fields, which turns out to be due to the employment of artificial fertilizer electrically manufactured. In the evening the house, the yard, stables and out-houses are radiant with electric light. In the kitchen there is an electrical oven, with four hot plates, a roasting oven, and a baking oven. When the food is cooked it is placed in an electrical heating apparatus. There are also electrical apparatus for cooking eggs and heating water. In the pantry there is a $\frac{1}{2}$ h.p. motor, to which can be coupled nine different machines, such as a sausage mill, coffee mill, knife polisher, machine for cutting bread, ice machine, and a press to obtain juice from berries. The whole house is heated by means of electricity. In his bedroom the farmer has an electrical apparatus for heating water for shaving, and the housewife a neat electrical hair-curling apparatus. In the wash house is a 3 h.p. motor, driving a washing machine, and an electrical centrifugal drier, as well as an electrical mangle and an electrical iron. The workshop is equipped with an electrically driven lathe, saw, grindstone, glue heater and soldering iron. In the stables for cows and horses there is a motor of $\frac{1}{8}$ h.p., to which apparatus for rubbing-down horses and shearing sheep can be coupled. There is also a milking apparatus, which is driven by a 1 h.p. motor. In the same building is a portable 10 h. p. motor, which supplies power for working the threshing machine and other agricultural machines. An electrical incubator is shown in another part of the exhibition. The whole exhibit shows excellently how the conditions of a farmer's life can be improved and how pleasantly and easily nearly all the work can now be carried out electrically.

ELECTRIC DISTRIBUTION

STANDARDS AT SAN DIEGO.

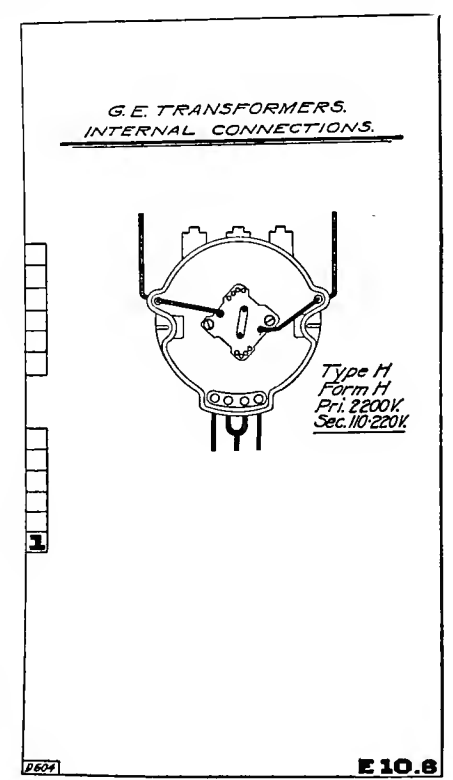
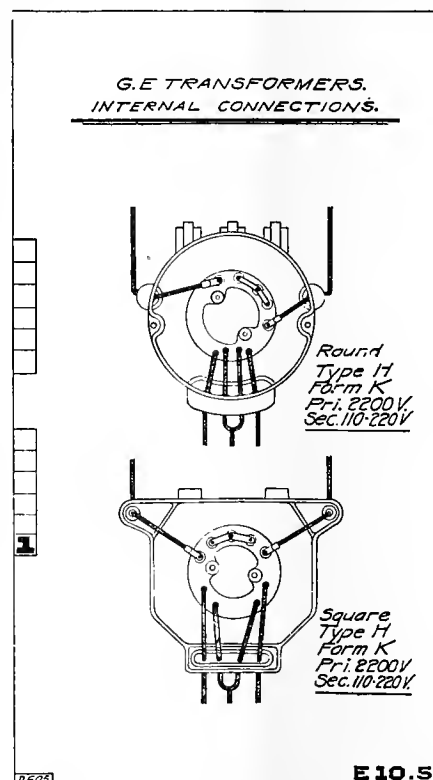
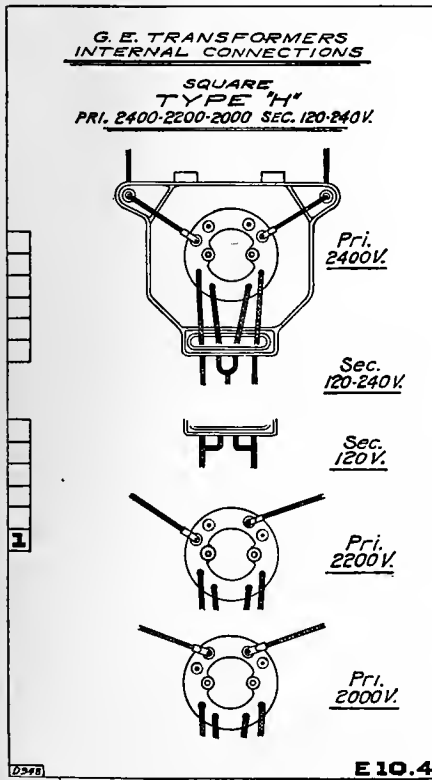
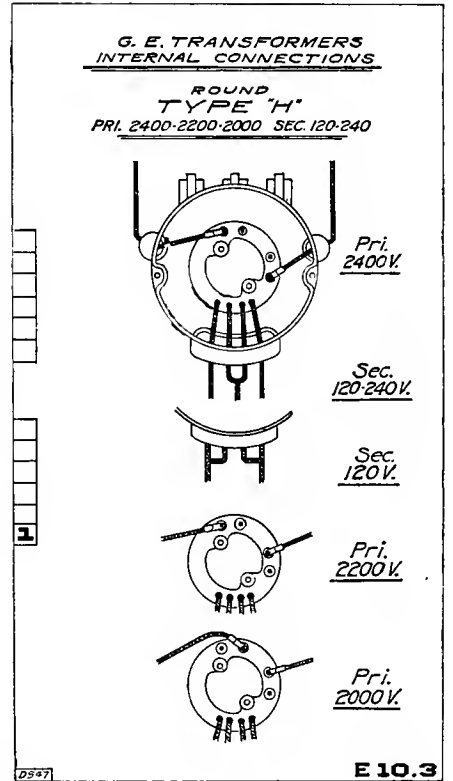
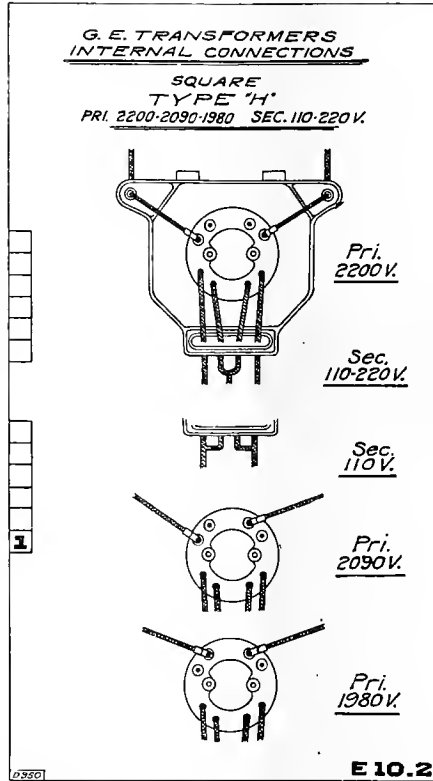
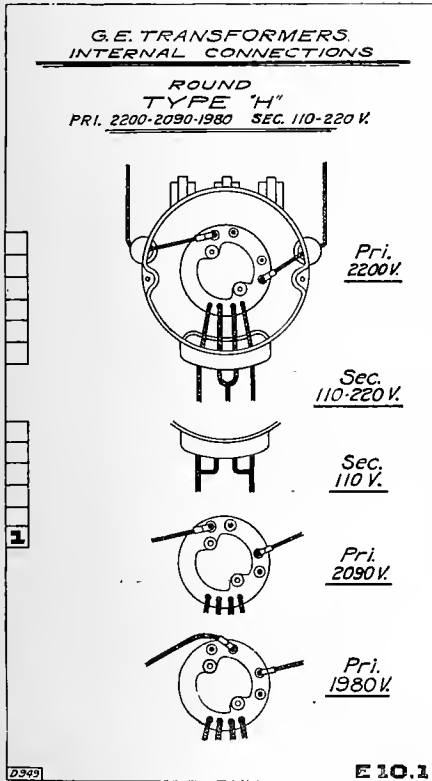
E. Transformers.

BY L. M. KLAUBER.

[Continued.]

This section contains information along the following lines:
E 10 Internal Connections. E 50 Weights.
E 20 Grounding. E 60 Case and Oil Data.
E 30 Fuses for Transformers. E 70 Wiring Diagrams.
E 40 Sketches for Hanging.

E 10: Internal Connections. Connection diagrams are inserted in the handbook for each type and form of transformer on the company's lines. These diagrams are elementary and to a certain extent are duplicated for the several types; however it has been found advisable to show the exact appearance of the



transformer terminal blocks for each form of transformer, as linemen are sometimes confused by diagrammatic sketches. This is the reason for such repetitions as E 11.1 and E 15.1.

It will be noted that there is an unnecessary variation in taps and secondary voltage arrangements; this is due to the fact that transformers were formerly purchased without adherence to standards. Present standard ratings are as follows:

For 2300 Volt Service:

40 k.v.a. or less—2400-2280-2160/240-120.

50 k.v.a. or more—2400-2280-2160/480-240-120.

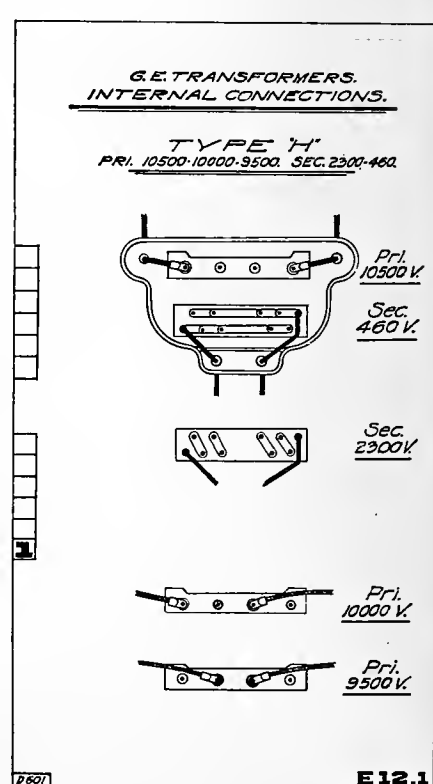
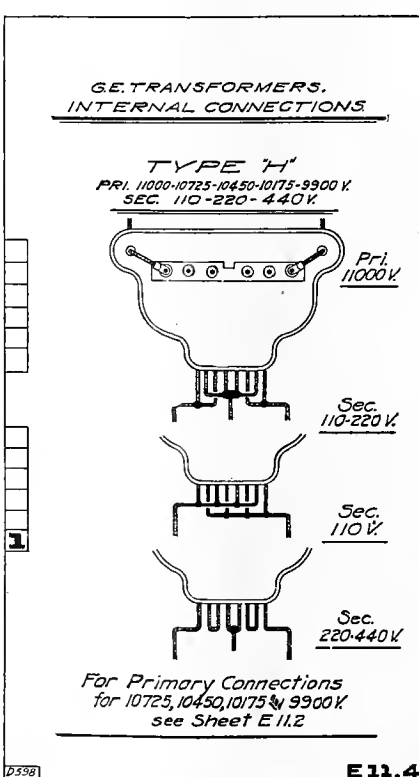
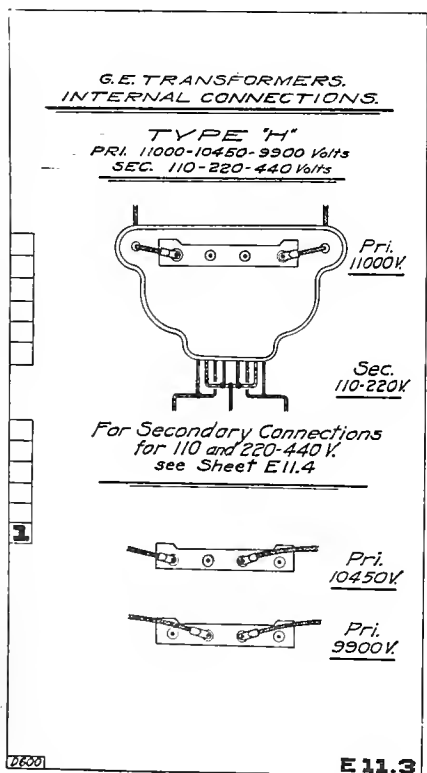
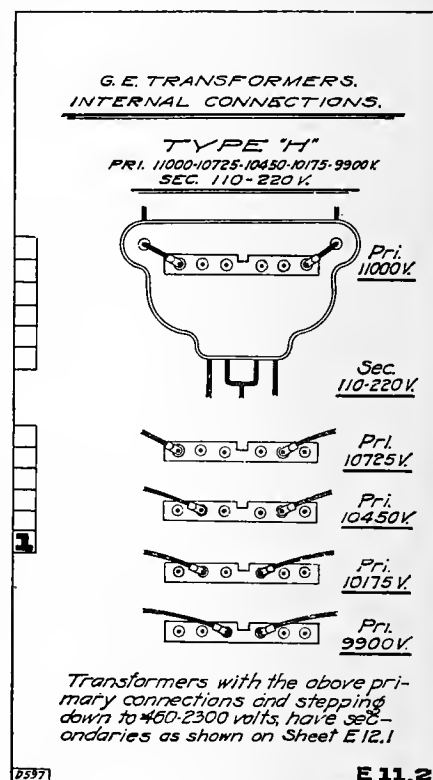
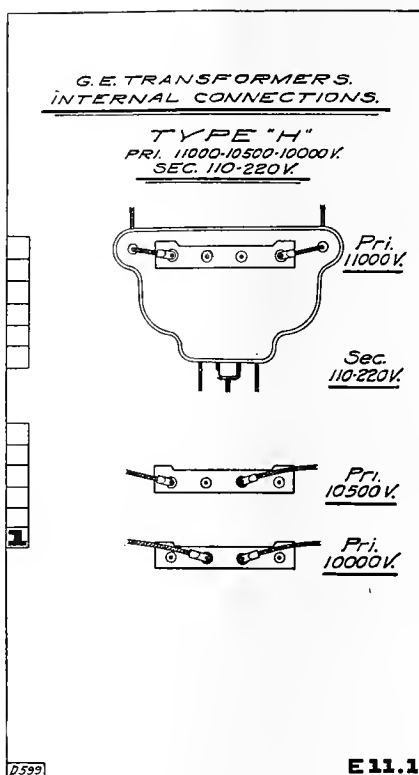
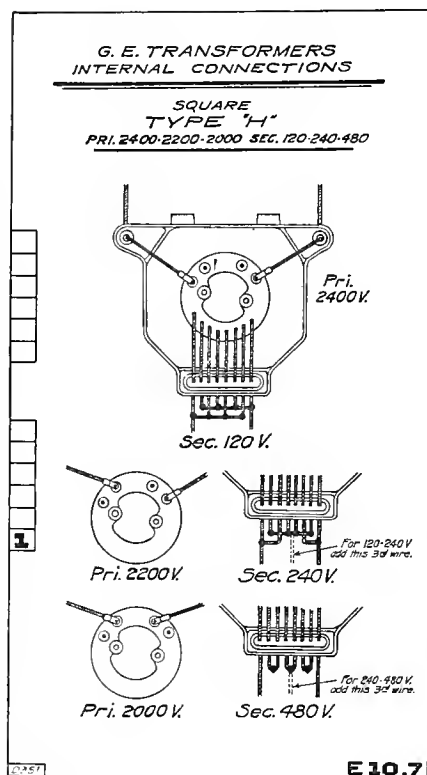
For 11,000 Volt Service—low voltage secondaries:

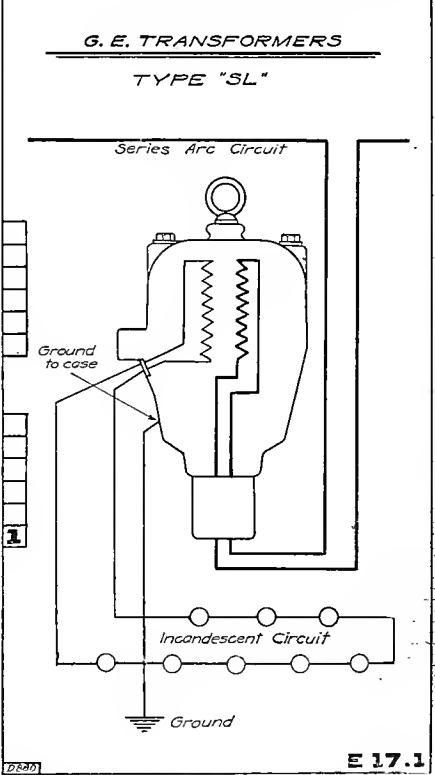
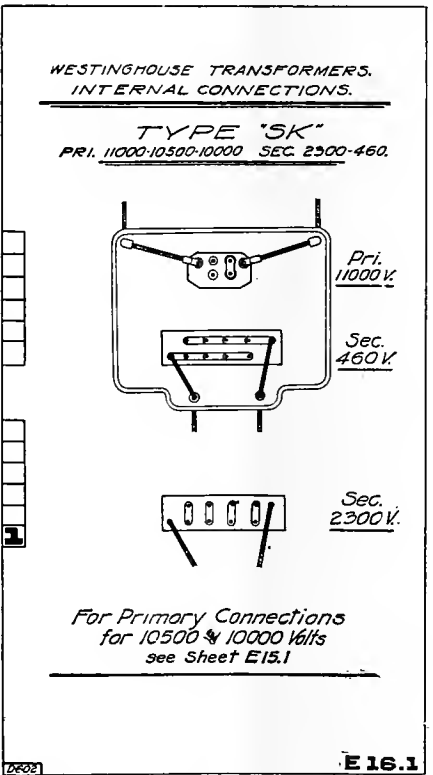
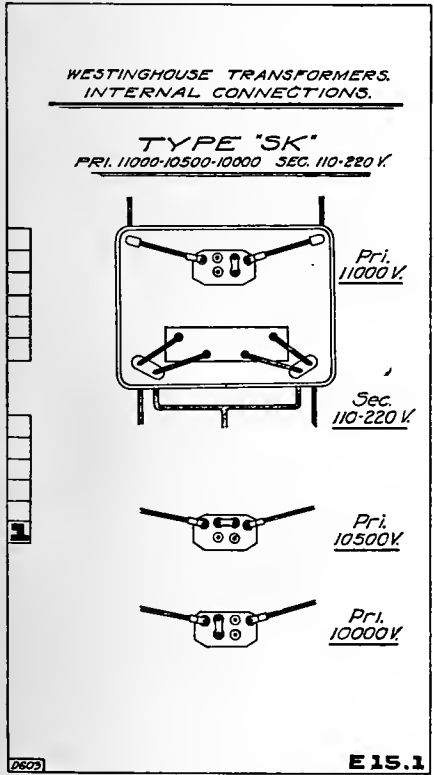
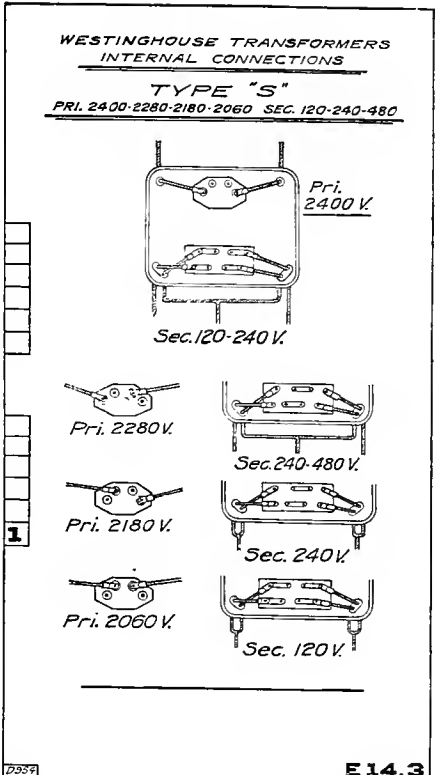
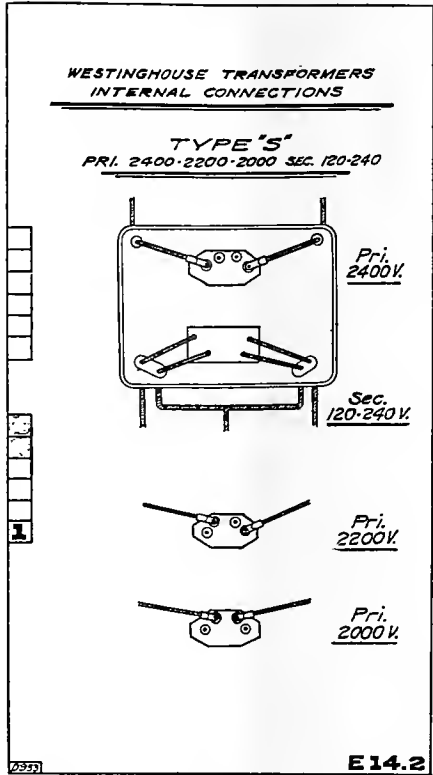
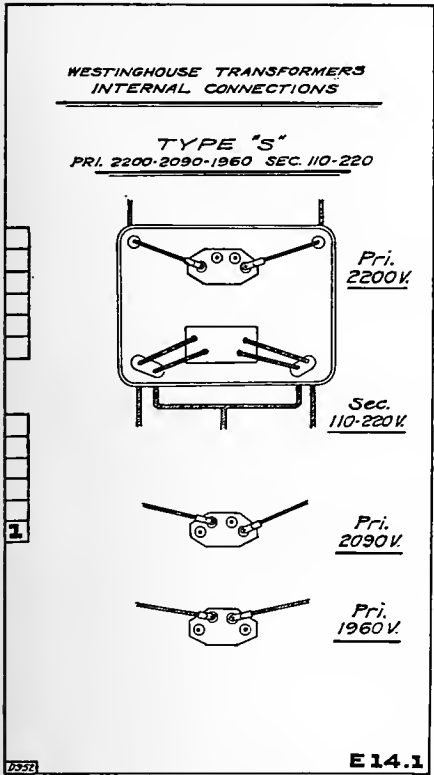
30 k.v.a. or less—11,000-10,500-10,000/230-115.

For 11,000 Volt Service—medium voltage secondaries:

10 k.v.a. or more—11,000-10,500-10,000/2300-460.

Occasionally 11,000 volt transformers are purchased with 4-2½ per cent reduced capacity taps instead of 2-5 per cent taps as noted above.





The office record of transformer stations contains, besides the usual information as to the transformers installed and load connected, data on the tap in use to facilitate the proper interpretation of voltage charts. By this means when corrective measures are required definite information concerning the change of taps to be made can be given the trouble man with a reference to the proper connection diagram in the book.

[To be continued.]

The tungsten resources of the United States are probably considerably larger than have been generally realized. Many new deposits have been discovered

in various parts of the Western States, according to the United States Geological Survey, and, should prices advance, it is probable that the output could soon be increased, much above the record year of 1910, when 1821 tons were marketed. Most of these new discoveries are not sufficiently developed to show how large an output can be expected from them; but it is probable that some will prove to be of considerable extent, and one or two new large producers would make a noticeable difference in the American market. Similar discoveries may also be expected in other parts of the world.

ELECTRICAL SUPPLY JOBBERS' MEETING.

The regular quarterly gathering of the Pacific Coast electrical jobbers and their friends, the electrical manufacturers' representatives, was held at Del Monte, Cal., September 24, 25, 26. As usual the main subjects of contention were golf and pool, the results being shown in detail herewith.

At the open meeting on Saturday Mr. T. E. Burger read a paper advocating more creative sales work by jobbers. This paper is printed in full in this issue. An extended discussion was held by those present and this subject will probably also form the subject of a paper on the other side at the next meeting.

Judge T. M. Debevoise, counsel for the association, explained that the association is purely an educational organization and has nothing to do with fixing of prices or restraint of trade.

He described a recent innovation in the service given to the members whereby the products of any manufacturer can be listed in a general catalogue a copy of which is furnished to each jobber. The manufacturer has only to bear the cost of printing and distributing the sheets describing his product.

Further service consists in educating the members on sane methods of merchandising and more economical handling and distribution of supplies.

It was emphasized that no inquiries are made as to how the manufacturer markets his product nor does the association restrict the members in their dealings with manufacturers.

The association invites inspection of its affairs by governmental authorities and is following a policy of free, frank and open publicity of its doings.

At the golf dinner on Saturday evening, H. V. Carter, as toastmaster, presented the various winners with their trophies, each responding with a few words.

MANUFACTURERS. Del Monte and Jobbers' Cup.

	Gross.	Handicap.	Net.
Bibbins	98	0—	98
Davis	95	+8	103
Clapp	97	+10	107
Hall	103	—13	90
Hyde	111	—12	—99
Lillard	84	+10	94
Pounder	130	—18	112
Murray	96	—10	86
Young	87	+2	89
Hansen	94	+5	99
Seaver	97	—18	79
Dunbar	111	—15	96
Poss	104	—12	92
Squires	109	—18	91

JOBBERS'.

Jobbers' Copper Cup and Del Monte Trophy.				Pass & Seymour, Contractors'.			
	Gross.	Handicap.	Net.	Gross.	Handicap.	Net.	
Berry	101	0	101	99	0	99	
Burger ...	106	0	106	105	0	105	
Carter	100	+5	105	91	+5	96	
Colwell ...	98	0	98	100	—18	82	
Debevoise..	101	+5	106	100	+5	105	
Goodwin ..	91	+5	96	94	+5	99	
Hills	89	+9	98	83	+9	92	
Hall	111	—12	99	...	...	...
Leggett ...	98	+5	103	98	+5	103	
Taylor ...	131	—24	107	135	—30	111	
Overbagh..	99	—0	99	99	—0—	99	

In the jobbers' tournaments W. L. Goodwin was announced as the third time winner of the jobbers' copper cup which can never become the permanent possession of any winner. He also received the Del Monte

trophy. J. I. Colwell was the first winner of the beautiful new Pass & Seymour cup which will eventually be awarded to a three time winner. The contractors' cup was awarded to F. H. Leggett, as having the fourth best gross score.

In the manufacturers' tournament W. H. Seaver won the jobbers' cup and the Del Monte trophy.

The pool tournament was won by O. W. Lillard with C. C. Hillis as runner-up, handsome cups being awarded in each case.

Those present at the meeting were as follows:

Phil. Aaron, Fobes Supply Co., Seattle.
W. Shelby Berry, Western Electric Co., San Francisco.
T. Elwood Bibbins, General Electric Co., San Francisco.
T. Ernest Burger and wife, Western Electric Co., Los Angeles.
Harry Byrne, North Coast Electric Co., Seattle.
H. Von Carter, Pacific States Electric Co., San Francisco.
Ralph B. Clapp, Manufacturers' Agents, Los Angeles.
J. Irving Colwell, Western Electric Co., Seattle.
H. Harmony Cudmore, Mazda Bureau, San Francisco.
E. Metallus Cutting and wife, Edison Storage Battery Co., S. F.
R. James Davis, Century Electric Co., San Francisco.
T. McElrath Debevoise, Jobbers' Association, New York.
W. Robert Dunbar, Westinghouse Elec. & Mfg. Co., San Francisco.
A. Howell Elliott, Secretary, San Francisco.
W. Lincoln Goodwin, Pacific States Electric Co., San Francisco.
Newton W. Graham, Holabird-Reynolds Elec. Co., Los Angeles.
Silas Gregory and wife, Arrow Electric Co., San Francisco.
W. Brewster Hall, Pass & Seymour Co., San Francisco.
Clarence B. Hall, Illinois Electric Co., Los Angeles.
A. Hobart Halloran, Journal of Electricity, Power and Gas.
B. Alvin Hansen, A. G. Electric Co., San Francisco.
C. Clement Hillis and wife, Electric Appliance Co., San Francisco.
Park B. Hyde, Thomas A. Edison Inc., San Francisco.
C. De Witt La Moree, Westinghouse Elec. & Mfg. Co., L. A.
F. Hamilton Leggett, Western Electric Co., San Francisco.
Ogden W. Lillard and wife, Gould Storage Battery Co., S. F.
Frederick W. Murray, National Carbon Co., Los Angeles.
Franklin Overbagh, Overbagh & Ayres Mfg. Co., Chicago.
F. Henry Poss and wife, Benjamin Electric Co., San Francisco.
Wilbur Pounder, Hubbard & Co., San Francisco.
Frank J. Quinn, Manhattan Elec. Supply Co., San Francisco.
Harold Sanderson, Bryant Electric Co., San Francisco.
W. Hibbard Seaver, U. S. Steel Products Co., San Francisco.
Herbert B. Squires, H. B. Squires Co., San Francisco.
S. Henry Taylor and wife, Elec. Ry. & Mfrs. Supply Co., S. F.
Ashley G. Young, Telephone & Electric Equipment Co., S. F.
C. Edward Wiggin, Dunham, Carrigan & Hayden Co., S. F.

CREATIVE SALES WORK BY JOBBERS.

BY T. E. BURGER.

(This paper advocates that the electrical supply jobber do more creative sales work and concentrate his lines. It was presented at the Del Monte meeting of jobbers and manufacturers on September 27. The author is the manager of the Western Electric Company at Los Angeles.—The Editor.)

If a manufacturer adopts a policy of recognizing the jobbers' important and salutary field of action to the extent of distributing his entire output through him, does the jobber's obligation end when he has his shelves well stocked with that manufacturer's product and fills orders for same on demand of his trade? Or is it to be expected that the jobber will demonstrate his approval of the manufacturer's confidence and co-operation by endeavoring to create a call and a market for his goods?

Generally speaking a jobber should do his utmost to create business on lines of goods having genuine merit and which can be marketed at fair profits.

A jobber who will specialize in sales effort on one meritorious line, particularly if there are numerous other competing lines, will be a far more successful distributor than one who is willing to accept orders for any make of article called for by the whims of his customers. The truth of this statement is self evident

and is epitomized in the one word CONCENTRATION.

By this is not necessarily meant that we should refuse to accept orders for any other make than that which we are exploiting, as this is a question of individual or company policy.

The jobber derives manifold advantages from creative sales work and by identifying himself with a particular line of goods. The most important of these advantages are:

Salesmen doing creative, or missionary work must, of necessity, know their goods thoroughly and are therefore able to impress their customers with a sense of this knowledge, thus associating the article with the salesman and the company he represents.

Such a salesman is aiding a manufacturer whose policy is a distinct help to the jobber, and a correlation of interest exists between all parties, which is very essential to successful merchandising.

Creative sales work on the jobbers part offers an object lesson to manufacturers whose policy is to ignore the jobber and go direct to the trade—a tendency which, in some localities, is becoming more manifest each day.

If the jobbers' customers have confidence in the jobber, they are also going to rely on the goods which that jobber stands behind and is exploiting in every possible way. Maximum effectiveness cannot exist if we try to increase our business on several lines that are practically identical.

Creative sales work develops the best there is in the salesman and gives him something worth while to talk about, leaving an impression in the customer's mind that the salesman is not merely calling to collect an order for anything that's needed. A salesman who does no creative sales work is little better than the average grocery solicitor who calls every morning to take orders for whatever the housewife finds is required to replenish her larder. Such a salesman is bound to become less and less effective, and therefore less valuable to his company as a business producer.

Let us take a hypothetical case: Smith has just been awarded the electrical contract for the Travelers' Hotel. Green, representing the Usual Electric Company, jobbers of electrical supplies, calls to get some business from Smith and says, "Mr. Smith, I was glad to hear of your securing the contract for the Travelers' Hotel and rushed right over to congratulate you and make sure that you wouldn't forget us on the material."

Smith says "Why, yes, I'll give your company some of the business. How would you like to furnish the wire and switches?"

"Fine! How much and how many are you going to need?"

"Well, I haven't figured out the exact quantities as the architects have made a few changes in the plans. By the way, what make of switch do you handle?"

"Oh! we carry Excelsior, Ne Plus Ultra and High Flier in stock, but if you'd rather have Bingo or Sickem we can get them for you."

"All right, come around about the end of the week and we'll see what we can do."

Exit Green and his price book after making a pass of one cigar.

Scene II. Same place, half hour later. Enter Wise of the Efficient Electric Company.

"Good morning Mr. Smith; glad to hear you have the Travelers' Hotel job. Came over to give you a valuable tip. Here's a chance to save yourself a clean sixty dollars."

"How?"

"Well, you know our company is pushing Bingo switches and we want you to use them on this job. The price of the switch is the same as any inferior make, but the quality is far superior. Just take a look at this sample. See that little hickey over against that screw. Well, all you have to do is push the wire against the hickey and the wire curls right under the screw head. Other manufacturers have tried to copy that but they can't seem to get it as perfect as the Bingo people. One of our customers who uses nothing but Bingo switches says that one thing saves him five minutes' time per switch on finishing. Now five minutes of a wireman's time is worth about 4 cents to you, and as I understand there are some 1500 switches to go into the Travelers' Hotel you save \$60. And that's only one of the many good features possessed by the Bingo switch. Our company doesn't try to sell any other for we have found this to be the best. The Bingo is made by a first class manufacturer who stands behind it and so do we."

Whether Green or Wise obtains the order is not germane. Which of the two salesmen has impressed his personality and the individuality of his company on the mind of the customer? The one who was doing creative sales work or the one who would be satisfied with an order for anything?

After this when Smith thinks of the Efficient Electric Company he is quite apt to think of Bingo switches, and if he thinks of Bingo switches he is surely going to think of the Efficient Electric Company.

For the purpose of this illustration even if the Bingo switch had no particular merit all its own, the fact remains that Wise has accomplished a sales job and he can, if he finally procures the order, feel far more self satisfied than Green could if he secured it on a purely "personality-plus" basis, without a thing to talk about but giving the customer anything he wanted.

Another thing. Which means more to the trade, the jobber or the factory missionary? One of these systems of selling has left all the creative work to the factory representative, thus enhancing his importance in the eyes of the trade, while the other system has done the creative work itself, thereby enlarging the customer's conception of the jobber.

In doing introductory work it should be borne in mind by the manufacturer that the jobber faces a difficult situation and is doing work which would otherwise be costly to the manufacturer, since good real salesmen are scarce and high priced. Having this in mind the profit allowed should be commensurate with the effort expended and such as to encourage the jobber in exerting his best efforts.

The ultimate result obtained from a universal plan of creative sales work by jobbers, would be the elimination of the factory missionary, who is only too frequently a missionary of meanness, introducing, not only his legitimate wares, but illegitimate methods of

doing business. How many times are gifts, premiums, and various intangible values given to purchasers? And how often does the jobber bear the brunt of the customer's grouches when the latter finds that there is "nothing doing" when he orders again from the jobber? This does not mean that the factory representative is an unnecessary factor in other fields than merely missionary work.

Unquestionably a jobber cannot do effectual constructive work on two or more parallel lines, therefore we might enlarge on the benefits to be derived from decreased investment, reduction of stock-keeping costs, elimination of much clerical routine, abridgement of catalog, etc., but the main point is already covered, viz:

Creative sales work is a proclamation of the jobber's individuality. No creative sales work makes him a nonentity, or a commission man with a warehouse.

If we want to be something, if we want to stand for something in the eyes of our trade, if we want to augment the importance of our position in the great electrical industry, and most of all if we want to increase our profits, let us ourselves (not others) create a demand for the goods we have to sell.

LETTERS TO THE EDITOR.

Report on Inductive Interference.

To the Editor:—The report of the Joint Committee on Inductive Interference and the Railroad Commission's General Order No. 39 are the subject of an editorial in the issue of the Journal for September 19th, under the dual heading: "The Balance of Power."

Your diagnosis of the situation deserves hearty commendation. It is stated that "an unbiased observer cannot but think that the power companies were the original innocent aggressors," and let us add without malice aforethought that there are some which are not quite so innocent. General Order No. 39 is not primarily intended for the innocent aggressor.

Practically all transmission companies operate telephone lines paralleling and generally, on the same poles with their high voltage lines, and if we are not familiar with the conditions governing good telephone service, from the experience gained thereby, General Order No. 39 may prove a revelation to us. There are some telephone lines operating on pole lines carrying 60,000 volts or more, and extending over long distances and which, under normal conditions, are entirely free from inductive disturbances. Again, there are some exchange lines operating in the vicinity of one leg of a 5000 volt a.c. lighting circuit, which are so noisy as to be absolutely useless for communication purposes. There is, between these extremes, an extensive series of conditions which, we assume, the Joint Committee has classified, and has endeavored to eliminate the freaks and near freaks of what constitutes established practice in power transmission.

The first common battery telephone exchange on the Pacific Coast was installed in 1903 under the writer's supervision. This was used for despatching and exchange purposes of the Pacific Electric Railway system. Being also responsible for the operation of the high tension, trolley and feeder lines of the same system, it was not difficult to establish the relationship between good and bad telephone service. Invest-

tigations and tests by all the telephone experts available, together with the co-operation of the power department, led to the early abandonment of common battery for despatching purposes. It became necessary to cut these lines off, as far as practicable, from exchange lines, and the despatching lines were thereafter operated as independent units on the magneto system; and the same methods adopted at that time are still in use today.

Lines terminating on a common battery switchboard, or any other board of standard type, communicate and augment accumulated inductive disturbances. What chance, therefore, has a telephone company, operating many thousands of exchange and other lines, of giving even fair service when the switch board represents the easiest point of discharge for the charges and leakage currents of many miles of high tension parallels?

This is the question which has been fairly and honestly put to the Joint Committee on Inductive Interference, and it should be noted that the power companies' component on this committee had not offered a serious protest as yet, nor has it rendered any minority report on the investigations of the committee, nor is it to be anticipated, as it is well known that these companies contributed funds for carrying on this investigation to obtain the answer to a very vexing problem, regardless of who would consider themselves injured thereby.

We hear a great deal in this decade about commercial co-operation and engineering ethics. The non-descript type of co-operation, which consists of aggressive condemnation of regulations intended for the public benefit, reflects adversely upon our common sense, and, in making this statement, reference is not made particularly to the opponents of General Order No. 39.

Co-operation consists largely of giving a fair deal and demanding the same in return, and seeing that we get it. As an instrument of enforcing the fair deal upon the power and communication companies, General Order No. 39, and the report of the committee which accompanies it, will go down in history of line construction and operation as a classic. It hits the power companies hard in spots and, from an operating standpoint, it is regrettable that it may be necessary to adopt an extensive transposition scheme for the high voltage lines, but the innocent aggressor need not suffer in the least. The power companies operating in Southern California have little to fear from the effects of the order. It will be necessary to adapt operating conditions to eliminate some features condemned by the committee, and even this need not be done except when it is fully determined as the direct cause of trouble on communication circuits. Our companies have already gone far in eliminating the troubles referred to.

An agreement existing between the power and communication companies includes the following article in its specification:

In general, light, power and railway circuits of over 5000 volts, alternating current, shall not be placed on poles erected on the same side of the street, highway, public or private place, occupied by telegraph, telephone, or signal circuits, nor on the same street, highway, public or private place, where long distance lines of the telegraph, telephone

or signal companies are maintained, if same can be avoided at reasonable expense, nor shall telegraph, telephone, or signal circuits be placed on poles erected on the same side of the street, highway, public or private place, occupied by light, power or railway circuits of over 5000 volts, alternating current, nor shall long distance lines of the telegraph, telephone or signal companies be placed on the same street, highway, public or private place, which has previously been occupied by light, power or railway circuits of over 5000 volts, alternating current, if same can be avoided at reasonable expense. It is understood that telegraph, telephone and signal circuits, used only for operating light, power and railway circuits of over 5000 volts, and not available for the use of the public, are exempt from this provision. Exception to the preceding provisions may be had upon regular application in writing and under suitable specification prepared by the committee for each case.

It took several years to bring this up to its present form, each advancement being of constant endeavor for improvement in service and safety on a co-operative basis, and the Joint Committee on Inductive Interference, backed by the authority of the railroad commission, has carried us forward several years at a single stride. This is the very essence of regulation, where apparently opposing forces, not understanding each other's problems and necessities, fully adapt themselves almost automatically to the mandates of authoritative and competent jurisdiction.

It should be particularly noted that where it becomes necessary to make any changes upon existing systems, in order to comply with the retro-active features of the order, the burden of expense should be borne by the beneficiaries. In the present situation, it is hoped that the committee will not be disbanded, and if it is found that mistakes have been made, their rectification will be an easy matter, and if it is found that the rules are not stringent enough, let us co-operate with the committee as engineers and accept the result accordingly.

Respectfully,

J. E. MacDONALD,

Secretary Joint Pole Committee.

Los Angeles, Sept. 26, 1914.

THE UTAH LIGHT & RAILWAY COMPANY SOLD.

Salt Lake City, Utah.—Local and eastern capital associated with the Utah Power & Light Company of this city and the Electric Bond & Share Company of New York have purchased from the Harriman system a controlling interest in the Utah Light & Railway Company and have organized the Utah Light & Traction Company to take over this property, the Utah Light & Railway Company passing out of existence by the transaction.

The Utah Light & Traction Company is incorporated for \$10,000,000 and its officers and directors include some of the most prominent business men in Salt Lake.

O. J. Salisbury of Salt Lake is president of the new company, C. W. Johnson and R. C. Gemmell of Salt Lake are vice-presidents, together with C. E. Groesbeck of New York.

The treasurer is S. A. Whitney of this city, and the assistant treasurers are E. O. Howard of Salt Lake City and Eugene P. Summerson of New York. A. H. Parsons of this city is secretary of the company.

The assistant secretaries are J. M. Bidwell of Salt Lake and Lawrence W. Osborne of New York.

The directors of the new corporation are as follows: O. J. Salisbury, S. A. Whitney, A. H. Parsons, C. W. Johnson, R. C. Gemmell, J. M. Bidwell, E. O. Howard, J. Frank Judge, and Joseph S. Wells, the general manager of the Utah Light & Railway Company and who has been a director in that concern.

The financial interests controlling the Utah Power & Light Company—the General Electric Company—have interested themselves, together with local capital in the newly organized Utah Light & Traction Company. But the Utah Power & Light Company itself has at this time no direct connection with the new corporation.

However, it is said that within a short time the lighting, street railway and power interests of the Utah Light & Traction Company will be divided. The railway end of the business, it is said, will remain with the present company, and the lighting and power business will be taken over by the Utah Power & Light Company. At the same time the latter corporation will contract with the former to furnish all current for lighting and for the operation of the street car system.

This deal was finally consummated on September 18th when the stockholders of the Utah Light & Railway Company met and voted to ratify the sale agreement which had been negotiated by the management. Holders of the preferred stock of the former company may exchange their shares at par for the stock of the new company or they may receive cash at par for them. Holders of the common stock of the former company may exchange them for stock of the new company or may receive cash for them on the basis of 47 per cent of their par value.

The officers of the new company immediately issued a statement that they contemplate at the present time no radical changes in management or policy. Joseph S. Wells, general manager of the Utah Light & Railway Company has been appointed to the same position in the United Light & Traction Company and all of the department heads in the former company have been reappointed to their same positions with the new company.

Just eight years ago this month Mr. E. H. Harriman who had unlimited faith in the future of Salt Lake City purchased controlling interest in the Utah Light & Railway Company. The property had been held for several years by interests who were unable themselves to provide sufficient money to meet its rapidly growing needs or to maintain it on a substantial operating basis. The cars, road bed, transmission and distribution system and practically the entire physical property were in a run down and dilapidated condition. In line with Mr. Harriman's well known policy of first putting a company in first class operating condition and being willing to wait for returns, work was immediately started on the reconstruction of the system and during the succeeding five years it was practically completely rebuilt so that the property acquired by the new owners is a new, thoroughly modern and efficient one.

In the fall of 1912 the Electric Bond & Share Company began to acquire electric properties in Utah

and southern Idaho believing that this region offered a splendid field for the development of profitable electric service of all kinds. They organized the Utah Power & Light Company with a capital of \$40,000,000 which was later increased to \$45,000,000 and preparations were made immediately to consolidate the majority of small electric generating and distributing companies then in the field and to inaugurate extensive new development work. Between \$6,000,000 and \$7,000,000 was set aside for the construction of new power houses and transmission systems planned by the company, while a very large sum was immediately invested in the purchase of establishing power plants and distributing lines.

The first class of properties united by the Utah Power & Light Company consists of complete systems generating, transmitting, reducing and distributing hydroelectric power. The second class consists of substations and distributing systems and to the third class belong the power plants taken over from companies that had built them for private use or as a limited side issue of their own works.

In the first group—complete systems generating, transmitting, reducing and distributing power—the Utah Power & Light Company consolidated the following concerns:

The Telluride Power Company (Utah-Idaho department), Provo, Utah; The Knight Consolidated Power Company, Provo, Utah; The Idaho Power & Transportation Company, Idaho Falls, Idaho; The Bear Lake Power Company, Montpelier, Idaho; The High Creek Power & Light Company, Richmond, Utah; the Davis County Light & Power Company, Farmington, Utah; and the Park City Light & Power Company, Park City, Utah.

The second class of companies consolidated by the Utah Power & Light Company consisted principally of concerns engaged in retailing electricity and the following companies were taken in under this classification: Idaho-Utah Electric Company, Preston, Idaho; The Merchants Light & Power Company, Ogden, Utah; The Home Telephone & Electric Company, Farmington, Utah; The Institute Electric Company, Bingham, Utah; The Electric Company, Provo, Utah; The Eureka Electric Company, Eureka, Utah; and the Camp Floyd Electric Company, Mercur, Utah.

The third group of properties taken over by the Utah Power & Light Company included principally power plants of private and public service corporations, the purchases consisting of the following: The power plant of the Utah Copper Company, at Garfield, and the plant of the Blacksmith Fork Light & Power Company, Ogden, Utah, (both of which are leased); and the power plant of the Salt Lake & Ogden Railway Company, Farmington, Utah; the plant of the Davis and Weber Counties Canal Company, Riverdale, Utah; and the power plant and transmission system of the Utah-Idaho Sugar Company, Collinston, Utah.

Serving a territory extending, as stated above, from Ashton, Idaho, 300 miles south through Idaho and Utah to Eureka, Utah, the total hydroelectric generating capacity of these 19 companies consolidated by the Utah Power & Light Company is 51,345 kilowatts, while the steam generating capacity is 9400 kilowatts.

This makes a total capacity of 60,745 kilowatts generated by the various power plants as follows:

The power plant at Idaho Falls on Snake River, 1875 kilowatts; the plant at St. Anthony on Snake River, 75 kilowatts; the plant at Teton on the Teton River 100 kilowatts; the power house near Georgetown on the Georgetown Creek, 180 kilowatts; the Paris plant on Paris Creek, 650 kilowatts; the Grace power house on Bear River, 11,000 kilowatts; the Preston plant on Cub River, 550 kilowatts. These power plants are all in Idaho.

The Utah plants and the kilowatts generated by each are as follows:

Near Hyrum on Blacksmith Fork, 2500 kilowatts; near Collinston on Bear River, 7125 kilowatts; near Logan, on Logan River, 2000 kilowatts; near Brigham City, on Willard Creek, 300 kilowatts; near Ogden on Weber River, 3750 kilowatts; near Farmington, on Farmington Creek, 312 kilowatts; two near Murray, on Mill Creek, together 1700 kilowatts; at Alpine, on Alpine Creek, 1750 kilowatts; two near American Fork, on American Fork River, together 2150 kilowatts; near Pleasant Grove on Battle Creek, 2400 kilowatts; at Olmstead on Provo River, 7200 kilowatts; near Santaquin, on Santaquin River, 880 kilowatts; near Heber, on the Provo River, 2500 kilowatts; near Midway, on Snake River, 1180 kilowatts; near Park City on Ontario drainage tunnel, 169 kilowatts.

All of the above plants are hydroelectric power houses, the water power being furnished by the rivers and creeks on which they are located.

In addition to these, the steam plant at Farmington, Utah, generates 800 kilowatts; the steam plant at Garfield, Utah, 8500 kilowatts; and the steam plant at St. Anthony, Idaho, 100 kilowatts.

Over 1398 miles of three-phase transmission line carries the power generated by these Idaho and Utah power houses.

The officers of the Utah Power & Light Company are as follows:

D. C. Jackling of Salt Lake, one of the foremost mining operators in the world and the executive head of the Utah Copper Company, is president of the company. W. S. McCornick of Salt Lake, head of the banking house of McCornick & Company recognized as one of the leading financiers of the west, is senior vice-president. P. B. Sawyer of Salt Lake is vice-president and general manager, and G. B. Thomas of Salt Lake is secretary and assistant treasurer. S. Z. Mitchell of New York City is chairman of the board of directors; G. M. Dahl of New York is vice-president; G. E. Claflin of New York is vice-president and E. P. Summerson of New York is treasurer.

The Utah directors of the company include M. H. Walker, president of Walker Brothers, bankers of Salt Lake; T. R. Cutler, general manager of the Utah-Idaho Sugar Company, Salt Lake; P. J. Moran, Salt Lake, contractor; C. W. Nibley of Salt Lake and C. E. Loose of Provo, Utah, together with Mr. Jackling, Mr. Cornick and Mr. Sawyer, all of Salt Lake. The other directors of the company are James Campbell of St. Louis, Missouri; Charles Hayden of New York; J. R. Nutt, Cleveland, Ohio; Mr. Mitchell of New York; John M. Hayes, and R. W. Breed, both of New York, and Bulkley Wells of Telluride, Colorado.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION CONVENTION.

The proceedings of the first day's meeting of the Northwest Electric Light & Power Association convention at Spokane, September 9, 10, 11 and 12, appeared in these columns September 19.

The association re-convened at 10:30 a. m. September 10 with M. C. Osborn in the chair. L. A. McArthur, assistant general manager, read his paper on

"Organization and Operation of Branch Offices and Plants."

This paper is not so much of a treatise as a record of the actual experiences of the Pacific Power & Light Company in handling its branch offices and takes up in detail the different methods and systems which that company has developed as the most efficient methods of handling an organization of this character—taking up the actual arrangement of the organization; the manner in which supplies are ordered and received; the authority of the local manager in dealing with the public.

The first part of the discussion was largely concerned with addressograph practice, E. H. West asking questions and L. A. McArthur answering them. The bills of most of the branch offices of the company are addressed at one office and shipped by mail or express. The machine is also used in getting out part of the pay-rolls.

H. V. Gates spoke of the difficulties of systematized accounting with the small clerical force necessarily employed by small plants. Robt. A. Foster stated that the Lewiston-Clarkston Company's policy likewise was toward simplicity of accounting. The necessity for simplicity was confirmed by Geo. Nixon. P. A. Bertrand emphasized the importance of adequate records of every transaction and the importance of standardizing forms.

Mr. McArthur outlined the details as to size of organization necessary for towns of different populations. J. M. Davidson spoke of the small percentage of slow accounts and the wisdom of leniency to farmers.

In closing the discussion Mr. McArthur dwelt upon the confusion caused by too many rules and regulations.

Meeting was then adjourned until 2 p. m., when J. M. Kincaid occupied the chair while M. C. Osborn and J. E. Davidson read their supplementary papers on **"Extension of Electric Service Into Small Communities and Districts."**

Mr. Osborn's paper was devoted to the reasons and methods for obtaining business in new and small suburban towns. Shows preliminary estimates of revenue, construction costs, and the actual results obtained after one year of service. Also gives a general outline of the company management in the suburban towns.

Mr. Davidson's supplement was concerned with electrically operated pumping plants in rural districts, especially touching on construction, operating costs and earnings, based on the actual experience of the Pacific Power & Light Company in serving rural customers. Further mention is made of rates, contract periods, and data which will be of special interest to central stations furnishing this kind of service.

In discussing these two papers Arthur Gunn corroborated the statement that the modern farmer demands and is willing to pay for electrical conveniences. He spoke of the necessity of maintaining a business policy, once it has been established and commented upon the unsatisfactoriness of having the farmers re-

port their own meter readings by post card. He also spoke of the high cost of making extensions and the necessity for a permanent basis of charge. He believes in a long-time contract based upon maximum demand and is anxious to get a satisfactory three-phase meter. Warning was given against making contracts with partnerships, where one partner is very likely to become delinquent.

G. D. Longmuir stated that in the Pasco district of the Pacific Power & Light Company during 1913 there were 107 small irrigation customers having an average connected load of 6.22 h.p., paying an average of \$24.85 per h.p. year, representing a revenue of \$6.20 and a connected load of $\frac{1}{4}$ h.p. to the acre. During 1914 the revenue will exceed \$28 per h.p. year, with corresponding future increase as the farmer becomes more familiar with the apparatus. Further details of load conditions were given and the necessity of thorough familiarity with the farmers' business emphasized.

G. R. Hall stated that in the Hood River district, where there is little or no irrigation, that they figure on eight customers per mile of rural distribution line. They keep within the estimate of three years' gross revenue covering cost of construction by cheapening their construction. They figure an annual revenue of \$30 from each rural consumer. It is advisable to have a representative of the company meet the individual farmers at least monthly.

H. S. Wells spoke of the care exercised in ascertaining the financial standing of the rancher. N. W. Brockett stated that long time contracts should be taken with the proviso that in case the rates are reduced the customer shall have the benefit of the reduction.

E. Baughm stated that the Pacific Power & Light Company installs indicating instruments on equipments of 25 h.p. and over. Arthur Gunn spoke of the success of the traveling bill man. The discussion was briefly closed by Mr. Osborn and Mr. Davidson.

H. B. Peirce, assistant commercial agent Washington Water Power Company, then read his paper on

"Electrical Appliances."

This paper is intended to bring out the value of appliances and cooking loads to central stations. The appliances which have been found of proven value in securing this load are discussed in order, together with a brief discussion of the electric range and the electric hot water heater.

P. A. Bertrand opened the discussion by suggesting that the tactics of the gas men in placing appliances in the home could be followed with profit by the electrical men. Emphasis was laid upon the benefits of standardizing appliances and the advantage of having baseboard receptacles installed in each room of a residence. He suggested that fans be handled on a rental system, with the option of applying the rental on the purchase of the fan at any time.

J. C. Henkle of Portland believes that a more thorough canvass of the lines of any company will place many new appliances. He stated that the Portland Railway, Light & Power Company had not yet found a satisfactory water heater from the standpoint of economical consumption. The company makes minor repairs free of charge with the purpose of keeping the appliance in use.

[To be continued.]

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Known bondholders, mortgagees, and other security holders, holding 1 per cent or more of total amount of bonds, mortgages, or other securities, none.

E. B. STRONG, President.

Sworn to and subscribed before me this 24th day of September, 1914.
(Seal.)

CHARLES EDELMAN,

Notary Public in and for the City and County of
San Francisco, State of California.
(My commission expires April 7, 1918.)

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Coincident with the definite announcement that the Panama-Pacific International Exposition will be held at San Francisco in 1915 comes the assurance that most of the technical conventions which have been scheduled for that period will also be in session, notwithstanding European disturbances.

The Exposition
Technical
Conventions

Such conventions as those of the National Electric Light Association or the National Electrical Contractors' Association would of course be affected only to a minor degree. While the plans of the International Engineering Congress have been somewhat disarranged as regards foreign participation, energetic work on the part of the officials in charge has already assured the success of the congress which will be held as originally announced.

Equally definite plans have not yet been formulated regarding the International Electrical Congress, though the Pacific Coast committee is confident of its probable success. A decision will be reached regarding this matter early in October, and even if it is then considered best not to denominate the gathering as international in scope, it is more than likely that a national convention of the American Institute of Electrical Engineers will be convened. Many foreign papers are available and the meeting could be international in every feature but name.

Within the past few years it has been recognized that a mere financial accounting is not sufficient for the intelligent operation of any manufacturing business. Considering the generation of electric energy for light and power purposes as a specialized branch of manufacturing, operators now require itemized cost statements in order to increase the plant efficiency.

Utility Cost
Accounting

Most public utility accountants are fully cognizant of the important place that their departments occupy, especially since commission regulation has made uniform methods mandatory, and sometimes the accountant seems to be slightly jealous of his prerogatives and to resent any change that may be suggested by the engineering department.

Yet the demand for a scheme of accounts which follows the practical and technical workings of each part of a great power net-work is so reasonable and so closely in accord with modern methods of efficient management that it behooves the expert accountant to adapt his fiscal statements to meet operating needs. Superior to all objections as to greater complexity and the high cost of such refinement arises the necessity for finding existing inefficiencies and losses. Proper executive and administrative control cannot be exercised unless definite information is available not only as to financial results but also as to operating costs.

While the present tendency to base rates upon the cost of service is likely to be short-lived it is never-

theless now followed by many rate-making bodies. The usual accounting forms do not give information that differentiates between the cost of supplying business and residence consumers, long-hour power users and spasmodic users, and sometimes does not even distinguish between the costs of hydroelectric and steam generation.

For some time the central stations have been looking to the National Electric Light Association to prescribe a uniform classification of accounts which will be flexible enough to show the cost of the several classes of service which the company may render. The way for such action has already been paved by the Railroad Commission of Oregon, which, with the co-operation of the utility companies has adopted a classification which involves this principle. This has been accomplished by the addition of a few headings and by arranging for the distribution of the investment and a subdivision of the operating expenses that will enable the books to show the cost of each step in the natural order of the operation of the system. By this means it is possible to reach a closer approximation of a proper rate schedule for all classes of service. At Portland, Oregon, the Portland Railway, Light & Power Company employs a diagram of property location as the basis for apportionment in its scheme of graphic accounting.

The usual accounting system shows the cost of equipment and operation without reference to their proportionate cost for the particular class of service being rendered. At any subsequent period it is a slow and tedious process to determine this cost of service, whereas it would be a simple matter if the apportionment were made in the regular course of records.

Heretofore cost keeping has been regarded as merely a branch of accounting, whereas present requirements suggest that it should be the main object. By this means it will be possible for the operating man to check results and for the administrative end to know the how and why of the fiscal statement, which can be readily superimposed upon the cost records. Such a method of analytical accounting will show the purpose as well as the nature of each expense.

In order that favorable action be taken upon this suggestion it is necessary that each member of the N. E. L. A. use his influence in getting the Committee on Accounting to consider the incorporation of these items in its recommendation. The holding of this convention on the Pacific Coast next year will afford an excellent opportunity to personally impress the association with the desirability of this proposal, and, it is hoped, will lead to definite action.

The traditional and commendable conservatism of the accountant should not prevent his hearty co-operation with the progressive ideas of operating engineers anxious to know their unit costs. There need be no fear that the accountant will ever be superseded by the cost engineer for the subject is one which is being agitated in other advanced fields of accounting and

the movement is in full accord with the belief that specialization makes for efficiency.

From time to time the question has been raised as to the need for the jobber in the electrical supply business and as frequently has this established method of distribution been proven an economic necessity.

The Jobber as a Business Creator

The modern jobber, especially under the conditions peculiar to the Pacific Coast, is far more than a middleman. His service to the consumer has been of unquestioned value and recently many innovations have been introduced whereby he can be of even greater service to the manufacturer.

The details of a proposal for creative sales work by the jobber are outlined in the paper by T. E. Burger published elsewhere in these columns. It is not the plan that such missionary work should supersede that of the manufacturer, but rather that it supplement and assist. The jobber localizes or intensifies the manufacturer's extensive campaign. This requires a co-ordination of effort and a mutual understanding so that one plan of action will not defeat the other.

The additional suggestion is made that the jobber should concentrate his efforts upon the product of one manufacturer, rather than scatter his energies upon similar products from competing manufacturers. The strongest argument in favor of such specialization is that it should accelerate the stock turn-over, experience having demonstrated that the more lines carried the slower the turn-over and consequently the higher the cost of doing business, especially in this Pacific Coast territory of great area and widely scattered customers.

Yet some specialties, particularly those requiring technical knowledge for their application, are not yet within the purview of the average jobbers' salesmen. The manufacturer requires an engineering representative to instruct the trade and the consumer regarding difficult features of installation. Frequently such products must be handled by an exclusive salesman. But in general, after wider use has caused such articles to become more and more staple, the jobber affords the more economical method of distribution. All economic progress is merely a process of converting superfluities into conveniences and conveniences into necessities. The methods for selling the electrical luxuries of yesterday are different from those for selling today's conveniences and must correspondingly change for tomorrow's necessities.

That this subject could be amicably discussed at the recent Del Monte meeting speaks well for the admirable spirit of harmony which now exists in this Western territory. There is naturally some difference of opinion on the subject and it certainly is a matter of congratulation that it could be discussed without recrimination. Yet no fair-minded man but will admit that no hard-and-fast rule can be prescribed to fit all conditions. Circumstances will ever alter cases.

PERSONALS

A. E. Brockway, electrical contractor of Seattle, Wash., was a recent visitor at San Francisco.

P. J. Aaron, manager Fobes Supply Company, has returned to Seattle from a visit to California.

H. W. Jacobs, electrical merchant of Santa Rosa, Cal., has returned from a short business trip to San Francisco.

K. G. Dunn, vice-president Hunt, Mirk & Company of San Francisco, has returned from a business trip to Seattle.

H. W. Briscoe, with the Wagner Electric Manufacturing Company of St. Louis, is at Los Angeles from St. Louis.

E. E. Warren, electrical contractor, Yuba City, Cal., was a business visitor at San Francisco the latter part of the week.

L. R. Wylie, manager Yosemite Power Company, Visalia, Cal., is at San Francisco to attend the annual meeting of his company.

E. F. Holland, manager of the Great Falls plant of the Montana Power Company, has returned to Great Falls from Seattle.

L. F. Youdall, manager Electric Machine & Equipment Company, Stockton, Cal., made a business trip to San Francisco recently.

G. Douglas Jones, electrical engineer state department of engineering from Sacramento, spent the latter part of the week in San Francisco.

E. P. Cullinan, electrical engineer for the Tonopah-Belmont Development Company, recently spent a few days on business in San Francisco.

C. L. Dobyns, illuminating engineer with the Sunbeam Incandescent Lamp Company, has established Pacific Coast headquarters at San Francisco.

W. L. Neelands, sales representative with the San Francisco office of the Western Electric Company, is again on the job, after a brief recreation in Sonoma County.

S. W. Deitrich, electrical superintendent for the San Joaquin Light & Power Corporation of Fresno, Cal., is expected to return from an Eastern trip early in October.

C. E. Heise, district manager of the Westinghouse Electric and Manufacturing Company, has returned to San Francisco from the district managers' meeting at Pittsburg.

C. A. Whipple has resigned as manager of the municipal light and water department of the city of Eugene, Oregon, to open an office as consulting and constructing engineer at Seattle.

W. J. Gough has succeeded **R. B. Talbot** as vice-president and superintendent of the Los Angeles and San Diego Beach Railway, which is electrifying its line between San Diego and La Jolla, Cal.

G. R. Kinney, formerly with the engineering department of the Railroad Commission of California, is now in charge of the statistical department of the San Joaquin Light & Power Corporation of Fresno, Cal.

Victor Kuehn has resigned as superintendent for the Levy Electric Company, San Francisco, to become manager of the construction department of the Gas & Electric Appliance Company, San Francisco.

W. D. Thomas, representative Electric Railway and Manufacturing Supply Company of San Francisco, is making a trip throughout the San Joaquin Valley. **H. F. Yost**, representing the same company, is covering Nevada.

C. C. Craig has resigned as commercial agent for the Northwestern Electric Company, Portland, Oregon, to become general sales manager for the Coin Machine Manufacturing Company, with headquarters in San Francisco.

Carl W. Beaton, formerly chief electrical inspector at Sacramento, is now acting city electrician, **Stanley Pearce** having recently resigned his position to become associated with **J. C. Hobrecht**, electrical contractor at Sacramento.

R. L. Eldringham, electrical engineer for the California State Accident Commission, has returned to San Francisco after an extended tour during the past three months over the lines of the various power companies of southern California.

P. M. Longan, treasurer and comptroller Mt. Whitney Power & Electric Company, Visalia, Cal., accompanied by **Fred G. Hamilton**, Eastern district manager, are in San Francisco to attend the annual meeting of the Yosemite Power Company.

C. D. La Moree, salesman with the Westinghouse Electric and Manufacturing Company, **Newton Graham** of the Holabird-Reynolds Electric Company, and **C. B. Hall** of the Illinois Electric Company, have returned to Los Angeles from a visit to Northern California.

W. S. Heger, Western director Busch-Sulzer Bros. Diesel Engine Company of St. Louis, has returned to San Francisco from a trip throughout the northwest and Salt Lake visiting several branches of his company and reports prospects much more promising than earlier in the year.

Geo. J. Henry, consulting engineer at San Francisco, has been admitted to practice before the United States Patent Office. His qualifications as an engineer and a number of years' experience in patent matters should particularly fit him for this class of work. This is in addition to the consulting and designing work, which he will continue as heretofore.

J. O. Presbrey has returned from the convention of the Holophane works of the General Electric Company. While there he effected arrangements whereby a new territory to be known as the Inter-Mountain territory has been created consisting of the states of Utah, Idaho, Wyoming, Montana, Colorado, New Mexico; and Spokane and El Paso. Mr. Presbrey will have charge of this territory with headquarters at Salt Lake City.

Thurston Owens, secretary of the San Diego, (Cal.) Gas & Electric Appliance Company, has been elected president of the San Diego Electrical League. Mr. Owens is a newcomer in San Diego and his election should dispel any ideas that it is necessary for one to be a "native son" to obtain recognition. Mr. Owens was formerly manager of the La Crosse (Wis.) Gas & Electric Company and has been in the public utility business for 15 years. He is the local secretary of the Illuminating Engineering Society, a Jovian, and several gas and electric associations. He has been a frequent contributor to the technical press.

C. G. Pyle, chairman of the Los Angeles Section of the American Institute of Electrical Engineers, has appointed the following committee to arrange for the entertainment and comfort of the electrical men who will visit Los Angeles during 1915: **B. F. Pearson**, general superintendent Southern California Edison Company, chairman; **C. S. Vance**, vice-president Los Angeles Gas & Electric Corporation; **E. R. Davis**, general manager Pacific Light & Power Corporation; **S. H. Anderson**, electrical engineer Pacific Electric Railway Company; **O. H. Ensign**, chief electrical engineer U. S. Reclamation Service; **Geo. A. Damon**, consulting engineer; **Max Loewenthal**, electrical engineer; **R. H. Monahan**, city electrician; **E. F. Scattergood**, chief electrical engineer Los Angeles Aqueduct Power; **J. A. Lighthipe**, electrical engineer Southern California Edison, all of Los Angeles.

MEETING NOTICES.

Sacramento Jovian League.

The Sacramento Jovian League held its regular luncheon on September 21, the chief topic of discussion being a Jovian theatre party or dance. Messrs. Beaton, Scoville and Dillon were appointed as a committee to take the matter in hand.

Engineers' Club of San Francisco.

At the bi-weekly luncheon of the Engineers' Club of San Francisco on September 30, Fletcher M. Hamilton, state mineralogist, gave an interesting talk on the mineral resources of California.

San Francisco Electrical Development and Jovian League.

The regular weekly meeting of the League was held Tuesday, September 29th at a downtown cafe. The subject of the day was San Francisco's Municipal Railway System, treated upon by Mr. Paul T. Ost, chief electrician of the system. No business was transacted as the meeting was devoted entirely to the speaker and his subject.

National Convention Electric Vehicle Association.

The finishing touches are being applied to the extensive program of the fifth annual convention of the Electric Vehicle Association of America, which will be held Monday, Tuesday and Wednesday, October 19, 20 and 21st at the Hotel Bellevue-Stratford, Philadelphia. Many interesting addresses and topics for discussion have been arranged for both the morning, afternoon and evening sessions of the three days of the convention.

Jovian Electrical League of Southern California.

The weekly luncheon of the League, held at Christopher's, Los Angeles, on September 23d, was hailed as "Industrial Los Angeles Day" and was attended by about 150 members and friends. After a few complimentary remarks on the enthusiasm shown by Jovian Briscow of St. Louis, and several good musical selections, chairman of the day, J. E. Tucker, introduced the speaker, G. A. Brock, chairman of the Industrial Committee, Chamber of Commerce, and Arthur W. Kinney, the Industrial Commissioner.

Mr. Kinney laid particular stress upon the tremendously important part which manufacturing plays in the up-building of a city. He ascribed practically all the best and most personally-beneficial growth of a large municipality to its factory products. Mr. Brock made an especial point of the necessity for co-operation, to secure the most far-reaching and lasting results in industrial development. He pointed out that this co-operation could extend all the way from that among kindred lines of business to mutual help by nations themselves in the industries. In this connection he scored the present government for giving "so much effort of late to the destruction of business."

In defining the importance of manufacturing, Mr. Kinney said:

"We are expending millions of dollars to make Los Angeles a world port and to increase our efficiency for commerce, both foreign and domestic. Expanding our facilities alone will not bring us the business that we so greatly desire. To get business, business must be given. Manufacturing alone will give the great cargoes that will bring a steady stream of gold to Los Angeles."

In this connection he contrasted Philadelphia with Galveston, showing that despite the fact that the latter was superior in its commerce, the former was by far the greater city on account of its manufacturing. He said that Los Angeles has all the requisites for a great and successful manufacturing city, such as raw materials, cheap fuel and power, efficient labor, transportation and markets.

The speaker drew a striking comparison between the value of a new manufacturing enterprise as compared with a convention. He pointed out that, despite the great virtue of conventions in attracting men and money here, the acquisition of a new factory employing forty men, which will mean the support of at least 200 people a year, accomplished the same benefits as a convention of 73,000 people here for one day, or 7300 for ten days. These figures are seldom, if ever, equalled, he said.

"Manufacturing, it is said, is the food source directly or indirectly of nearly nine-tenths of our nation's population," he continued. "Manufacturing has been profitable in all

America's leading cities, and it has paid in Los Angeles. Home investments have made more money for Los Angeles people than investments outside."

He cited figures from the last national census report demonstrating that out of every dollar spent for Los Angeles-made products at least 43 cents remains in our city.

In his talk Mr. Brock gave a description of the industrial bureau and some of the things it has accomplished. "One of the enterprises of the bureau has been the establishment of a government supply and contract service for the purpose of bringing local manufacturers, jobbers and others into closer touch with the almost countless purchases by the United States government of supplies of every description," he said.

"The maintenance of this service has already resulted in our home establishments receiving many orders for government supplies. The 2000 or more factories of our city cover many articles purchased by the government, and from now on many orders will be received for them."

He pointed out that the spirit of co-operation has spread from business of kindred lines, among associations in general lines, then among communities for general welfare, then to co-operation by the general public, and finally to co-operation by nations. "We need to develop this spirit in our own government, which has unfortunately been giving so much effort, of late to the destruction of business," he said.

In speaking of industrial development in Los Angeles he said: "It is my opinion that \$250,000 yearly spent in the upbuilding of our industries would be returned to us each year, in addition to increased assessed valuation made possible by new factories and homes erected for the new industries, as well as increased valuation to adjacent property, owing to the growth of industrial sections."

Oregon Society Engineers.

Commencing with Monday, September 28th, there will be held weekly luncheons at the Hotel Benson, in Portland, Oregon, under the auspices of the Oregon Society of Engineers. There will be speakers provided for each luncheon, who will talk upon live subjects. The first luncheon will be held in the Crystal Dining Room, W. D. B. Dodson will speak on "Commercial Opportunities of the Present."

The first meeting of the society for the coming season was held in the Public Library building Thursday evening, September 24th. C. F. Blake, president of the Northwest Oil Burner & Equipment Company, expressed his ideas how the society could be made of more value to all members. He stated that he did not think the presentation of professional and technical papers alone could serve to hold an engineering society together. He thought that in addition to technical papers that if the society would meet at 6:30 informal dinners that this would promote good fellowship and call forth a better attendance. He also pointed out that the Oregon Society of Engineers should aid the library association by outlining courses of scientific reading based on the technical library. These courses to be made adaptable to the needs of the younger engineers.

J. C. Stevens, hydraulic engineer, pointed out the great necessity of general adoption of the metric system in this country, and that it must be adopted if this country expected to get the foreign manufacturing. He urged that the society put forth efforts to encourage the general adoption of the system and invite other technical societies to join them in the movement. He thought the best way to bring about this result would be for manufacturers to revise their catalogues and when adding new machinery—such as rolls—for steel mills, to make the additions to their equipment on the basis of the metric system. Using the old equipment for the home market.

H. J. Stocker, field engineer light and power department Portland Railway, Light & Power Company, spoke upon the

necessity of the society having permanent headquarters with a few rooms available for the use of out of town engineers.

In the case of Mr. Blake's ideas of an education reading course a motion was made and carried that a committee be appointed to look into this matter and report at the next regular meeting. This committee is to confer with the University of Oregon and see if the co-operation of its Extension Course could not be obtained.

In regard to both the adoption of the "metric system" and the "permanent headquarters" ideas, motions were made and carried to appoint committees to investigate those subjects.

The society unanimously endorsed W. B. D. Dodson for an appointment under the recent bill passed by Congress to allow the Secretary of Commerce to appoint five commercial attaches with the U. S. legations in foreign countries. Mr. Dodson has spent a number of years in foreign countries. At one time he was connected with the promotion and sale of automatic telephone equipment in China and Japan.

MAZDA BUREAU ACTIVE IN CALIFORNIA CITIES.

The Mazda Bureau of General Electric Company is conducting an active co-operative campaign in the cities of Oakland, Alameda, Berkeley, Hayward, San Leandro, Fruitvale and Richmond for the exploitation of the trade-mark Mazda. The campaign centers about a large Mazda demonstration which is being maintained at Idora Park, Oakland, during the Alameda County Exposition and Carnival, which extends over a period of two weeks.

The Mazda Bureau has posted the cities mentioned with large attractive posters suggesting the meaning of the Mazda mark and connecting the Mazda demonstration with the distributors of Mazda lamps. The moving picture theaters are used to call the attention of the public to the Mazda demonstration and the window displays in electrical dealers' windows.

The direct personal co-operation of the Mazda Bureau has been extended to some 85 or 90 electrical dealers in the Alameda County cities through Mazda window displays installed and maintained by the bureau. This co-operative work has been at the service of distributors of all brands of Mazda lamps.

The campaign is in charge of Mr. H. H. Cudmore, Director of the Mazda Bureau, who is assisted by Messrs. F. J. Blaschke, in charge of publicity, and A. B. Bond and Clark Baker, field representatives.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Northern Electric Railway Company—Marysville and Colusa Branch, has filed an application requesting approval of notes previously issued amounting to \$37,079.50.

The Sacramento & Woodland Railroad Company has filed an application requesting approval of notes previously issued amounting to \$118,750.

The commission has issued an order granting the Marin County Electric Railways an extension of time until April 1, 1915, in which to sell the stock previously authorized for the construction of a street railway system in Mill Valley, Marin county.

TRADE NOTES.

The installation of the electric driving machinery for the cables of the California Street Cable Railway Company, San Francisco, is progressing rapidly. The work is being done under the direction of F. W. Lamme, consulting engineer.

The Newberry-Bendheim Electric Company of Los Angeles, has closed a contract with the Griffin Car Wheel Company of Chicago, for all the wiring and motors for their extensive new plant at Vernon, Cal. This embraces about

700 h.p. in motors and all the wiring for this \$300,000 plant is in conduits.

The electrical workers strike which has been brewing at Salt Lake City for the past two weeks was called on September 23rd as a result of the final refusal of the contractors to recognize in any way E. A. Wilcox as business agent of the workers. The electrical contractors all declare that there will be little delay in completing the contracts now on hand.

The school board at Murray, Utah, has recently let a contract for the complete electrical equipment of the domestic science department of the new Hillcrest High School. This will consist of 25-4½ in. Simplex 3 heat disc stoves equipped with a 1 pint saute pan and a 2 pint double boiler. The contract was awarded to the Inter-Mountain Electric Company.

J. W. Christensen of Fairview and C. A. Hammond of Moab, Utah, have recently placed an order with the Inter-Mountain Electric Company of Salt Lake City for a 50 k.v.a. generator with exciter and panel board direct connected to a Leffel water wheel and the necessary wires, cross-arms, transformers and distribution equipment to install an electrical distribution system in this city, a franchise for which was recently granted. They also propose to erect and operate a flour mill and an ice plant to be operated by this plant, as this city is badly in need of these two utilities.

The Underwriters' Equitable Rating Bureau of Portland, Oregon, has issued a circular calling attention to two forms of unapproved packing-house cord now appearing on the Portland market. The defect in one specimen is the absence of cotton braid on each of the conductors. The other specimen is defective in that no cotton or other winding is provided on the stranded conductor beneath the rubber insulation. This bureau will not sanction the use of nor approve any packing-house cord which does not comply strictly with the requirements of the National Electrical Code as given under Rule 54 and tabulated on page 105, edition of 1913.

NEW CATALOGUES.

National Lamp Works of the General Electric Company has issued a First Reader on Series Circuits and National Mazda Lamps for Street Series Lighting, which contains sales arguments on High Efficiency Mazda Street Series Lamps.

"New Ideas in Window Display" is the subject of a serviceable and timely bulletin published by the Westinghouse Lamp Company. Illustrations and practical directions are given for preparing five different styles of window display for retail stores.

Bryant Electric Company is distributing a handsome bulletin about the Bryant Silent Call Signal System for Hospitals, as well as offices, department stores, public buildings, etc. Illustrations and descriptions are attractively presented of typical installations and wiring details are also shown.

The Westinghouse Electric & Manufacturing Company has recently issued the following publications: Electric Drive of Rubber Calenders, Leaflet 3693. This publication deals with the advantages to be gained by the use of electric drive for this class of work, showing a number of illustrations of actual installations. Glue Pots and Glue Cookers, Folder 4293, show the method of installing an electrically heated glue pot and glue cooker, and the advantages to be gained from the use of same. Westinghouse Electric Drive for Flour Mills, is described in Folder 4287 in which some curves are given showing the load on a flour mill driven by electric motors. A complete equipment of these mills is given together with the advantages gained by this method of drive. Motor-Generator Sets, utilizing a direct-current generator and an alternating-current motor, are thoroughly described and illustrated in descriptive leaflet No. 3742. The advantages of this type of machine and its characteristics are described.



INDUSTRIAL



A NEW STRAIN INSULATOR SWITCH.

The Pacific Electric Manufacturing Company of San Francisco has recently designed a switch on which the line wires can be directly dead-ended. It may be equipped with one of sev-

The switch is group controlled by a square rocker shaft, having bearings bushed with brass, and the three units can be set at any position on this shaft, making this switch one that is particularly easy to install.

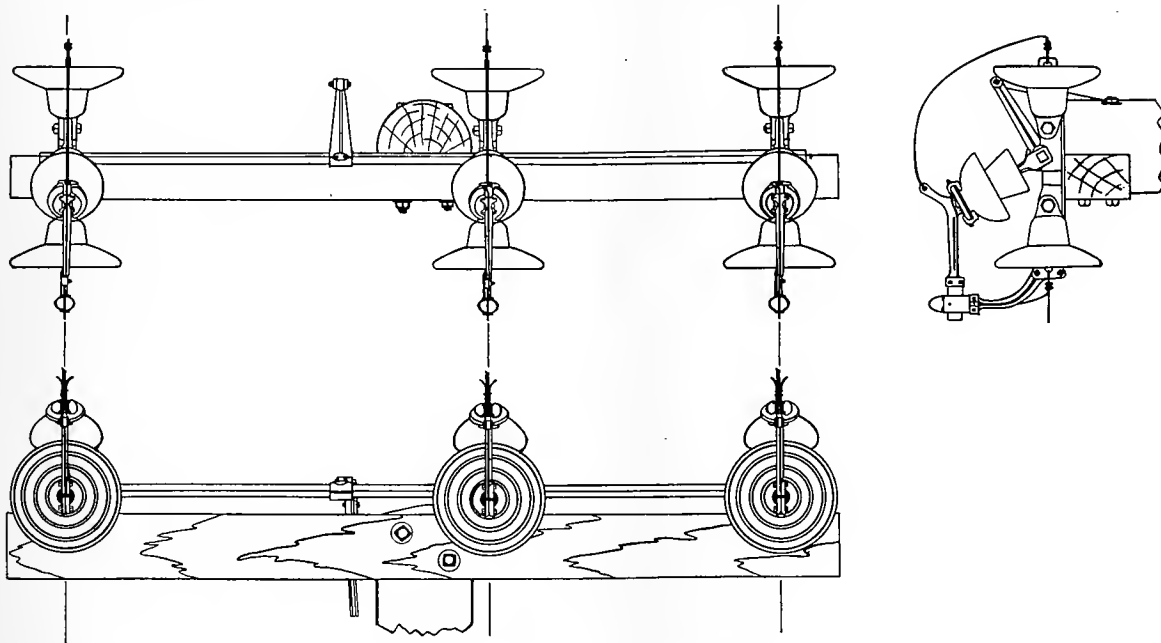
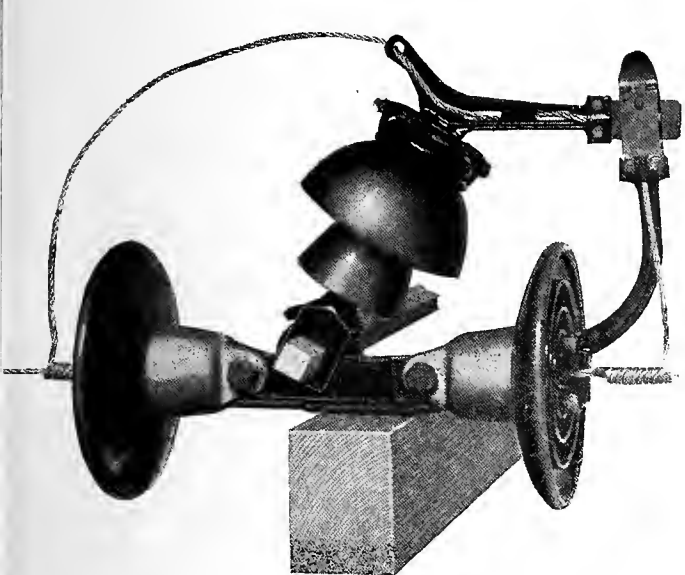
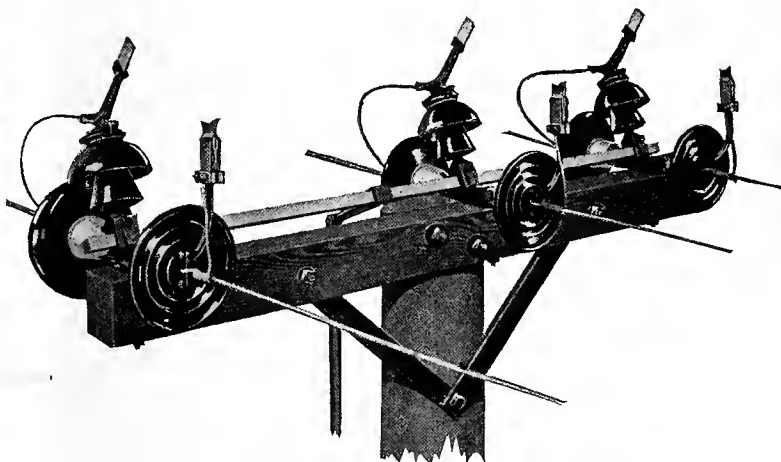


Diagram of Strain Insulator Switch.



End View of One of the Units of the Strain Insulator Switch Showing Adaptation of Standard Type of Insulator.



Strain Insulator Switch in Open Position on Pole.

eral standard strain insulators, which can be quickly and easily removed and replaced by other standard strain insulators, without cementing any special parts, and solely by loosening three bolts.

As the blade moves in a line parallel to the line wires and no conducting members extend to either side, the switches are spaced no further apart than the standard centers of the line wires. The switch is retained in the closed or open position by gravity. The strain insulators are immovable, and no strain, either mechanical or electrical, is added to their customary functions as strain insulators. The arc is drawn far above the porcelain.

All wrought iron and malleable parts are galvanized or sherardized. This switch can be furnished fully equipped with insulators or equipped with the pin insulators only, the strain insulators to be furnished by the purchaser. It can be installed on a single crossarm of the purchaser's standard length.

TRADE NOTE

With Fawcett Robison as designer, the committee on electrical display, of Los Angeles, with Secretary Zeehandelaar of the Merchants' and Manufacturers' Association as its head is arranging for the construction of fifteen electric floats for use in all parades in 1915. These floats will be mounted on street car tracks and will depict allegorical and other scenes. Reinforced by some of the Southland's fairest, these trucks will make attractive features for convention parades.



NEWS NOTES



FINANCIAL.

LOS ANGELES, CAL.—Bonds in the sum of \$281,250 have been voted at Arcadia for improvements. Of this issue \$131,250 will be spent to develop the municipal water plant.

GLENDORA, CAL.—Bonds in the sum of \$37,500 have been voted by the citizens for the acquisition of the second unit of the domestic water plant. A distributing system and pumping plant will be purchased at once.

SAN FERNANDO, CAL.—A communication has been received by the city council asking for the appraisal of the two local water plants by the State Railway Commission, and the calling of an election to vote bonds for the purchase of the two plants.

PASADENA, CAL.—No decision has been reached as to when the proposed water bond election will be held, the suggestion having been made that it be delayed until spring. The estimated cost of the water system, \$289,000, is also expected to be considerably reduced.

RICHMOND, CAL.—The proposition to bond the Richmond municipal water district for \$2,500,000 to bring a supply by pipe line from the Sacramento River at Tolands Landing has been defeated for a second time. The opponents in the main were opposed to river water, the sentiment being in favor of a mountain supply. The well system by which the city is now supplied can be developed to supply a large population.

AZUSA, CAL.—Preparations for a \$55,000 bond election to be called early in October are being made by City Attorney F. M. Steele for a new water system costing \$35,000 and a new lighting plant, costing \$20,000. The lighting system will include lights along Foothill boulevard, Azusa avenue and Center street, which will be arranged according to best methods obtainable and will result in the city being as well lighted as any other in the eastern district.

INCORPORATIONS.

LOS ANGELES, CAL.—The San Luis Electric Company of Los Angeles, \$50,000, subscribed \$5 by F. W. Morrison, H. F. Charles, W. W. Butler, J. P. Fulmer.

SACRAMENTO, CAL.—Amended articles of incorporation have been filed in the county clerk's office by the Sacramento Inter-Urban R. R. Company in order to cut the term of incorporation from 50 years to September 30th, so as to go out of business. The incorporators are W. N. Williamson, E. W. Johnson, Marshall Diggs, R. C. Waring, C. E. Hollister, J. T. Elliott and A. D. Kildahl. The company was originally formed to build a line to Roseville through the Haggin Grant.

ILLUMINATION.

NORWALK, CAL.—An electric lighting district will be established here as soon as it can be done under the law.

OLYMPIA, WASH.—The Crescent Oil Company will apply to the city council of Olympia for a franchise to serve the city with gas.

LODI, CAL.—The Lodi Gas Company will commence in a few days making a 600 ft. extension to its mains on South Hutchins street.

SPOKANE, WASH.—The contract for a gasoline gas plant to be installed at Whitworth college has been let to Thomas McCart of Spokane.

PORTLAND, ORE.—Permission has been granted by the war department to the Portland Gas & Coke Company to lay mains across Willamette below Milwaukie.

DEMING, N. M.—The Phelps-Dodge Company will install a power plant at once. The engines will be Diesel make. The work will be in charge of Albert Kohler.

YONCALLA, ORE.—An election will be held here in December to vote on the question of additional city indebtedness for the installation of an electric light system to cost \$6000.

ABERDEEN, WASH.—The revised franchise giving the right to sell gas in the city limits of Aberdeen to L. H. Burnett and a company of local business men, has been accepted by Mr. Burnett.

WARRENTON, ORE.—The city council has granted to the Pacific Power & Light Company a 30 year franchise to supply light and power in Warrenton. The system must be installed within 18 months.

WILBAUX, MONT.—A special election has been called to vote on the question of granting a franchise to Henry Zolph for an electric light and heating plant here. The estimated cost of the plant is \$20,000.

LOS ANGELES, CAL.—The board of public works has ordered that the lights be turned on at the ornamental lighting systems of the city fifteen minutes earlier during the months from October 1 to April 1.

TACOMA, WASH.—An ordinance has been passed providing for the equipment of all buildings that are piped for gas with an automatic gas cock, or other appliance whereby the gas may be shut off in case of fire.

THOMPSON, FALLS, MONT.—The Thompson Falls Power Company has awarded a contract to Boomer & Hughes, contractors, Spokane, for rock work at the power house site and lowering the bed rock to the final floor for machinery.

OLYMPIA, WASH.—The Crescent Oil Company has made formal application to the city council for a franchise to lay gas mains in the streets of the city of Olympia and furnish the people with gas from an oil well now being drilled near this city.

WARRENTON, ORE.—The council granted the Pacific Power & Light Company, Astoria, a 30 year franchise to furnish power and light in the city. Work will probably commence at once. The cost of the extension will approximate \$50,000.

SPENCER, IDAHO.—The public utilities commissioner has granted certificates of convenience and necessity to the Wood Livestock Company, F. J. Hagenbarth, president, to operate an electric generating plant and distributing system here.

LOS ANGELES, CAL.—The board of supervisors of Los Angeles county, Cal., will receive bids to October 13th, for installing and maintaining an addition to the system of street lighting in Lankershim Lighting District, in accordance with specifications on file with the board of supervisors.

CENTRALIA, WASH.—An electric franchise has been granted to the Independent Electric Company for a high power line from Winlock to Toledo. The franchise gives the company the right to run its line over the Winlock-Cowlitz road to the Cowlitz store, and over the Cowlitz-Olympia road and the John Tucker road.

LOS ANGELES, CAL.—The Pacific Light & Power Company wants to place a substation in the northwestern part of the city, this being necessary to increase the service in that section and in Hollywood. Members of the city council have made an inspection of the proposed location and probably will recommend the issuance of a permit.

PASADENA, CAL.—An ordinance has been adopted by the city commission fixing a standard of heating value of gas and a maximum price thereof, and requiring persons, firms or corporations furnishing gas to refund to property owners under certain conditions cost of connections to gas mains required to be made before streets are made.

LOS ANGELES, CAL.—The city council has appropriated \$3000 a month for five months for the appraisal of property of the three Los Angeles gas companies. The consensus of opinion of the councilmen was that the making of a new and independent appraisal for the city's use in combatting the suits of the gas corporations against the enforcement of the 40-cent rate for natural gas would settle the doubt in the public mind as to the adequacy of the valuations made by the board of public utilities.

TRANSMISSION.

VIRGINIA CITY, NEV.—The Truckee River General Electric Company will begin the extension of its power line from Line Grove to Rockland in Lyon county within a few days.

TONOPAH, NEV.—A contract has been closed by Nelson Bros. with the Nevada-California Power Company for the extension of its power line to Manhattan, a distance of 14 miles. Actual construction on the line will begin in a few days.

OCEANSIDE, CAL.—The Southern Sierra Power Company, with headquarters in Riverside, has decided to extend its high power electric wires to Oceanside, connecting up with the system at Elsinore, and tapping Fallbrook and other intermediate points. Active work will begin on the proposition as soon as financial conditions improve.

ROCHESTER, NEV.—The Rochester Mining & Milling Company has signed a contract with the Nevada Valleys Power Company for electric power for its new mill. The town of Rochester will be supplied with electricity, as the building of the power line was contingent on the signing of the contract with the Rochester mines people.

TRANSPORTATION.

SAN FRANCISCO, CAL.—Arrangements have been finally made with the old Geary street Railway Company to stand the cost of removing the rails and cable slot from Fifth avenue from Pt. Lobos avenue to Golden Gate Park.

SAN FRANCISCO, CAL.—The annual meeting of the stockholders of the Northern Electric Railway Company took place September 28th, the following board being re-elected: L. E. Hanchett, chairman; Leon Sloss, president; Percy Morgan, John McKee, John Drum, Louis Sloss and W. P. Hammon.

SAN RAFAEL, CAL.—Condemnation suits have been commenced here by the recently organized California Terminal Railway Company against Julia C. Bodkin, Salvador Pacheco, the Belvedere Land Company, the McNear Company and the Mt. Venice Company, all large Marin county land owners. Each suit sets out that the lands are desired for trackage purposes by plaintiff corporation, which is about to build a railroad from San Francisco to Sacramento.

SAN FRANCISCO, CAL.—City Engineer O'Shaughnessy has submitted detailed plans for certain improvements at the foot of Market street along lines decided upon at a conference between Mayor Rolph and other representatives of the city and the Board of Harbor Commissioners. The cost of the improvements is estimated at \$503,000. They contemplate the opening of a new street on vacant lots 137:6 feet south of Market street, from Steuart street to the Embarcadero. This will admit of looping Market street cars around the new block that will be formed, thus materially relieving the congestion at the foot of Market street during the exposition year. The estimates of cost include the following items: Cost of land for new street, \$380,000; rearranging of street car tracks and paving of new street, \$49,000; foot-bridge on north side of Market street to second story of Ferry building, \$28,000; foot-bridge on south side of Market street to Ferry building, \$31,000; changes necessary to Ferry building, \$15,000.

TELEPHONE AND TELEGRAPH.

LOS ANGELES, CAL.—September 20th fire broke out on the third floor of the Pacific Telephone & Telegraph Company's exchange on Hill street, causing a loss of \$1000.

VENTURA, CAL.—The Pacific Telephone & Telegraph Company has rented one-half of the Day building at Ventura as a store room and will immediately begin extensive improvements on lines between Ventura and Santa Barbara.

WILLOWS, CAL.—At a meeting here recently of the stockholders of the Glenn County Telephone Company, a committee was appointed to inquire into the business of the company. It is the belief that if the stockholders will agree to the price the plant will in the near future be turned over to the Pacific Telephone and Telegraph Company.

PORTLAND, ORE.—The Pacific Telephone and Telegraph Company for Portland and vicinity plans the expenditure of \$131,992 for extensions. The improvements will include 600 ft. of 22 gauge relief cable, 10,000 ft. of underground cable, pole line and aerial cable, toll cable at Hood River, and repair work. A large amount of work will be carried on along the highways.

SANDPOINT, IDAHO.—Sandpoint patrons of the Interstate Telephone Company may now have a long-distance connection with the Bell phones in Spokane. The cut-over from the Interstate to the Bell system in this city was made recently. This connection was made possible through the sale of the long distance lines of the Interstate Utilities Company. The new company is organized to engage in the telephone business in Spokane with a capital of \$1,000,000, by Philip Hamlin of Denver.

WATERWORKS.

SAN DIEGO, CAL.—The city council has directed the finance department to advertise for bids for material required in installing a new pipe line from Bonita. Steel pipe will be used.

LOS ANGELES, CAL.—Chief Engineer Mulholland of the aqueduct bureau announces he will prepare plans immediately for the distribution of the aqueduct water for irrigation purposes in San Fernando valley.

PASADENA, CAL.—The city commissioners have authorized the city clerk to advertise for bids at once for 350 lengths of four inch cast iron class B pipe; 300 lengths of 6 inch cast iron class B pipe, and 125 lengths of 8 inch cast iron class B pipe, together with fittings, to be used for new line in Hill avenue.

SPOKANE, WASH.—Petitions asking the city to grant municipal water service to the large district in the north-eastern part of the city which now is served by a private water system, formerly operated by F. S. Barrett & Company, have been put in circulation by residents along Nebraska, between Nevada and Morton. It is figured that about 3 miles of water mains would be needed for this section.

HONOLULU, H. T.—Lieutenant Colonel E. B. Cheatham, chief quartermaster of the Hawaiian Department, has received instructions regarding the Fort Kamehameha water system, but nothing regarding money for other permanent construction on the island. The Kamehameha water project is a fairly large item in itself, the estimates calling for \$100,000, which has been made available, but it is only one item of the general construction scheme. Just how much money will be spent here this year, and for what purposes, will not be definitely known until the advices are received from the war department. Work on the new twelve-inch well at Port Shafter, which is to supply the artillery post near Pearl Harbor, has begun, according to the department quartermaster. The well will be drilled as far as necessary, probably 400 feet. For the completion of the project which consists of piping the water to Kamehameha, about six miles and through the post, bids will be advertised for during the next 30 days. This work probably will be done by contract.

ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page opposite

- A-1 American Ever-Ready Works of National Carbon Co....
Los Angeles; 755 Folsom Street, San Francisco;
Seattle.
- B-1 Benjamin Electric Manufacturing Co.....
Rialto Bldg., San Francisco.
- B-3 Blake Signal and Manufacturing Co.....
680 Howard Street, San Francisco.
- B-5 Bridgeport Brass Co.....11
(See Pierson, Roeding & Co.)
- B-7 Busch-Sulzer Bros.-Diesel Engine Co..... 3
Rialto Bldg., San Francisco.
- C-1 Century Electric Co.....12
614 South Grand Avenue, Los Angeles; 56 Natoma
Street, San Francisco; Seattle; Spokane.
- C-2 Colonial Lamp Works.....
444 Market Street, San Francisco.
- C-3 Crocker-Wheeler Co.....
Title Insurance Bldg., Los Angeles; Salt Lake City;
First National Bank Bldg., San Francisco; Seattle.
- C-5 Crouse, Hinds & Co.....
Chicago, Ill.
- C-4 Cutler-Hammer Manufacturing Co.....15
579 Howard Street, San Francisco; Morgan Bldg.,
Portland, Ore.; San Fernando Bldg., Los Angeles.
- D-1 D. & W. Fuse Co.....12
(All Jobbers.)
- D-2 Dearborn Drug and Chemical Works.....11
355 East Second Street, Los Angeles; 301 Front
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THE MUNICIPAL RAILWAYS OF SAN FRANCISCO.

BY PAUL J. OST.

STANDARDS AT SAN DIEGO.

BY L. M. KLAUBER.

DUPLICATION BY MUNICIPAL UTILITIES.

BY GEO. A. LEE.

ARC LAMP PHOTOMETRY.

BY FORD W. HARRIS.

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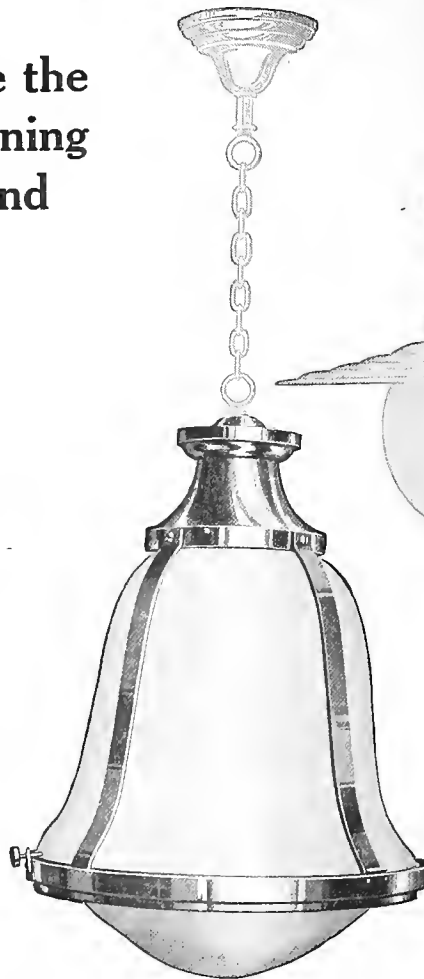
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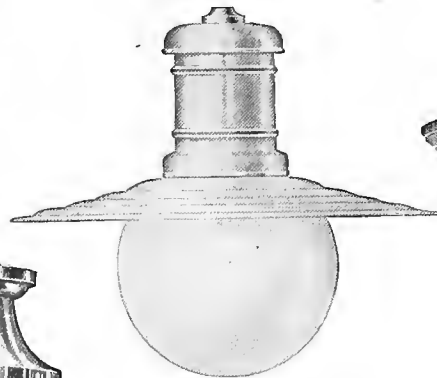
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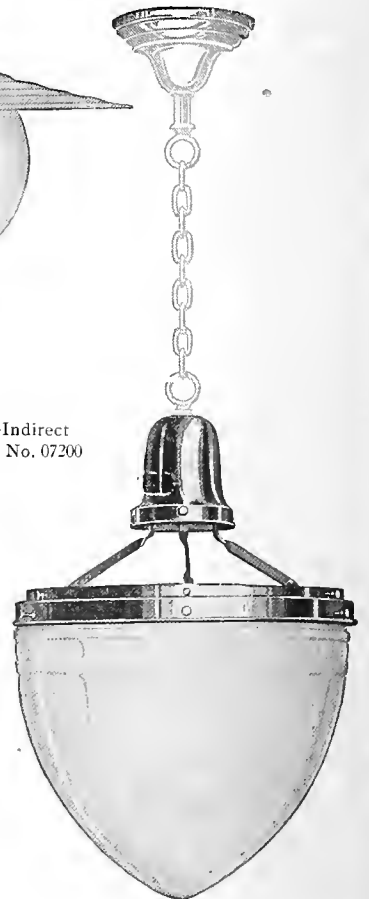


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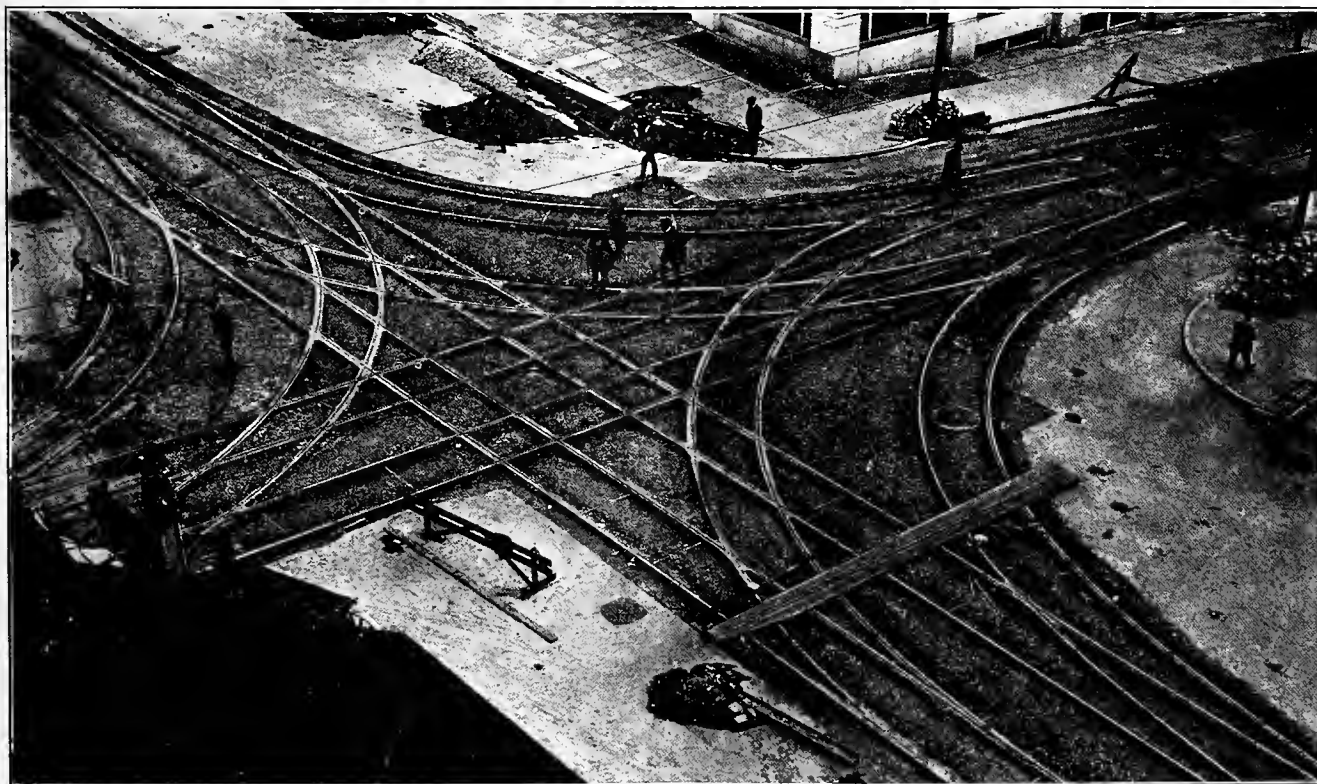
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THE MUNICIPAL RAILWAYS OF SAN FRANCISCO

BY PAUL J. OST.

The project for a municipal electric railway system at San Francisco has been agitated for many years. Just a few days before the disaster of 1906 bids were received for the building of an electric railway on Geary street over the route of the old Park & Ocean Railway, whose cable franchise was about to expire. The money for this work was on hand in the

third avenue was opened to traffic on December 28, 1912. Those portions on Market street and west of Thirty-third avenue to the beach were opened June 25, 1913. This road has been a paying proposition from the start and present indications, judging by the continued increase in receipts, are that the road has not as yet reached its maximum popularity.



Track Construction at Van Ness Avenue and Geary Street.

city treasury. The great fire, however, stopped the consummation of the plans, as the money had to be diverted to more urgent uses.

It was not until 1910 that the municipal railway problem was again opened. At this time bonds were voted for the construction of the present Geary street line, comprising 15.08 miles of single track. That portion of the line between Market street and Thirty-

Early in 1913, the directors of the Panama-Pacific International Exposition, realizing that the transportation facilities to the Exposition grounds were not adequate to carry the people they expected to attend the Exposition, requested the board of supervisors to provide additional transportation facilities in the way of extensions to the municipal railway system. The board of supervisors requested the city engineer, M. M.

O'Shaughnessy, to make a study of the conditions and recommend routes over which such lines might be constructed. This study was quite exhaustive—going into matters of finance as well as matters pertaining to the physical conditions. The studies along the financial side indicated that the receipts from the Exposition traffic would not, under any circumstances, be sufficient to produce sufficient profits to pay outright for the roads constructed. This meant that any line built which would not be a paying line after the Exposition period would be a loss to the city.

The following lines were recommended by the city engineer in his report of April 5, 1913, and will form the backbone of a municipal railway system covering the entire city; all being lines which it will pay to operate after the Exposition is over. The routes proposed were as follows:

1—The purchase of the Union street line of the Presidio & Ferries Railroad, extending from the Ferries to the Presidio, over Columbus avenue and Union street, a total distance of 3.77 miles.

2—Van Ness and Chestnut street line, commencing at Van Ness and Market, along Van Ness to North Point with an extension along the south line of the Exposition grounds commencing at Van Ness and Chestnut thence westerly on Chestnut to Scott and over Scott, Greenwich and Steiner streets to Steiner and Union, there connecting with the Union Street line, this extension forming a double loop just outside of the Fair grounds. The total length of this line was 3.38 miles.

3—Eleventh and Potrero avenue line, connecting with the Van Ness avenue line at Van Ness and Market, thence along Eleventh to Division, Division to Portreo, and Potrero to Twenty-fifth, a total distance of 2.08 miles.

4—Stockton street and Columbus avenue line, from Stockton and Market streets along Stockton street through the Stockton street tunnel to Columbus avenue connecting with the Union street line, thence along Columbus avenue to North Point street, along North Point street to Van Ness avenue connecting with the Van Ness avenue line. Included in the recommendation for this line was the construction of a line through Fort Mason Military Reservation to Beach and Laguna street where a loop terminal would give access to the rear entrance of the Exposition and also provide street railway facilities to the transport docks. The total length of these lines was to be 2.51 miles.

5—California street line. The United Railroads' franchise covering the right to operate over California street between Second avenue and Thirty-third avenue was about to expire. It was, therefore, recommended that a municipal line be operated over California street as a branch of the Geary street line connecting with the Geary street line at Second avenue and Geary street, thence over Second avenue, Cornwall street, and California street to Thirty-third avenue and California street, a length of 2.07 miles.

6—Church street line. A line connecting with the Van Ness avenue line at Market, thence along Market street to Church street and south on Church street to Thirtieth street, a distance of 2.65 miles.

This meant that the city would acquire a total of 16.46 miles of double track or 32.92 of single track. This, with the Geary street line already in operation, would mean a total mileage of the municipal railways of 48 miles of single track. This report was adopted by the board of supervisors and on August 26, 1913, the people were asked to vote \$3,500,000 in bonds to carry on the work. The bond election carried and the city engineer promised that if allowed to proceed with the work without hindrance practically all of the lines

could be complete and ready for operation on January 1, 1915. Voting the bonds, however, did not provide ready cash so that it was not until September, 1913, that the supervisors were able to provide the city engineer with \$15,000 with which to commence the preparation of plans and specifications.

It was early appreciated that some definite campaign must be planned in order that the work might be completed on time and with the least possible cost. Track, trolley, feed cables, cars and car barns must all be brought into synchronism so that there would be no time when a piece of track was lying idle awaiting the arrival of cars to run over it, or that the reverse exist—cars standing in the barn awaiting the construction of track to run over.

Careful study of all the conditions involved made it possible to so let out the work that as soon as money was spent it was possible to begin operation, thereby earning interest on the capital invested. The board of supervisors promptly took the necessary steps to secure the sale of the bonds and early in December the specifications were ready: On December 31st bids were received for rails and rail joints, tie rods, tie plates and braces, spikes, ties, track specials, car bodies, car trucks, motor equipments and air brakes and the board of public works awarded contracts for \$900,000 worth of material on January 2d. This was the earliest date on which contracts could be awarded legally as until this time no money was available and the charter requirements are such that money must be on hand in the treasury before contracts may be awarded.

This condition made it necessary for all of the work of construction to be completed within one year. Careful studies had been made of the market conditions and the contracts as prepared called for deliveries as early as could be expected under ordinary conditions. In order, however, to hasten the delivery as much as possible, each contract had a bonus and penalty clause inserted. Contractors were permitted to earn a bonus for early delivery of material, this bonus in most cases equalling approximately 6 per cent of the estimated amount of the contract. They were likewise penalized for each day consumed over and above the time specified. All of the material was not required at one time, in most cases 25 per cent being delivered at the earliest possible date while the remainder was to come forward in progressive shipments such as to permit the work to continue at a uniform rate.

The program as originally prepared has been carried out almost without change. In a few instances unfortunate and unavoidable delays have occurred. The greatest of these delays has been due to the discussion by the property owners as to gradients over which the Church street line would run. This is a matter entirely out of the control of the city engineer's office. If the stringency of the money market does not prevent the selling of the remainder of the bonds it is believed that all of the lines with the exception of the Church street line can be completed by January 1st or shortly thereafter.

Three of the proposed lines are already in service. The Union street line was taken over and placed under municipal control on December 10, 1913, the fran-

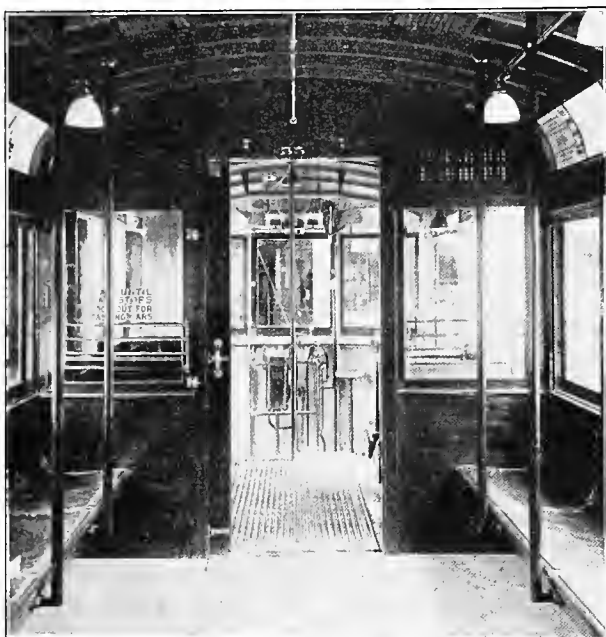
chise having expired on December 1st. The Van Ness avenue line was placed in service August 15, 1914. This date was eleven days less than one year from the time when the bonds were voted by the citizens and indicates the rapidity with which the work had been carried out. The second line to go into service was the Potrero avenue line over which cars commenced to operate on September 7th. Both of these lines were opened on practically the day set in the program.

To do this has meant a careful watch of the program, as it was essential that the contracts and specifications be ready on a certain date and that material be received by the time indicated on the program. Every man connected with the work was given to understand that he was directly responsible for the particular part entrusted with him and that his duty must be so performed as to fit the program time. At times

might demand power for operating lines other than the Geary street line although no such lines were contemplated at that time. To operate the Geary street line, the Pacific Gas & Electric Company installed three 1000 k.w. and one 575 k.w. motor generator sets. As soon as the bond issue for the new lines was authorized the company was requested to install another 7000 kw.

These machines are being placed in the company's regular substations, which are so spaced as to make the points from which trolley current is distributed not over a mile and one-half apart. This, it will be readily understood, allows the municipal railway to use short and fairly light feeders, besides insuring that the crippling of one station will not destroy the service to the entire system.

It is interesting to note in passing that the contract with the Pacific Gas & Electric Company provides



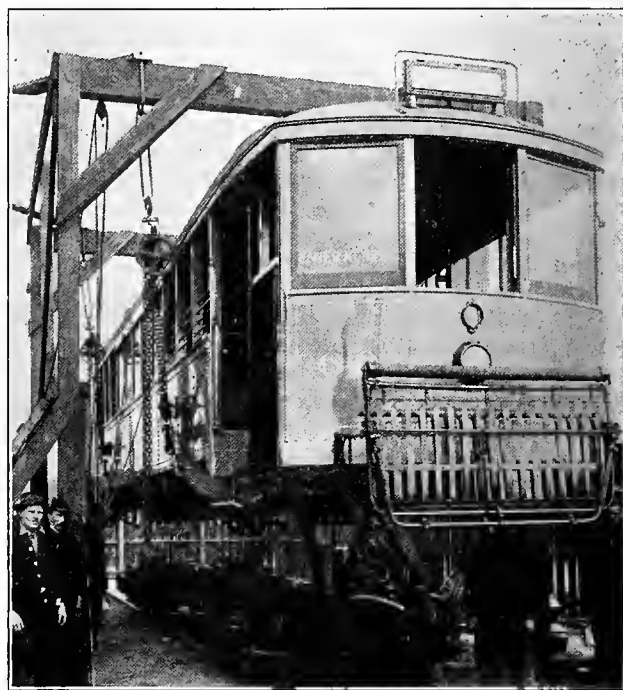
Interior of Municipal Car.

the burden has been particularly heavy but everyone has worked with a will, knowing that they were making a new record for railway building.

When the Geary street line was under construction it was proposed to generate our own power. To this end, a substation room was built in the Geary street car barn and a lot was purchased for a generating station at North Beach. Plans and specifications were prepared for substation machinery and bids called for.

Before commencing work on the generating station it was thought advisable to receive proposals for furnishing electric current. After some discussion there was also included in this contract the furnishing of 600 volt direct current delivered to the trolley wires. When the bids were opened it was found that the prices for the direct current were such as to make it advisable for the city to buy its trolley current delivered, the Pacific Gas & Electric Company being the successful bidders. No award of contract was made for the substation equipment and the generating plant was not built.

In the contract signed by the Pacific Gas & Electric Company, provision was made whereby the city



Lowering Car Body Onto Trucks.

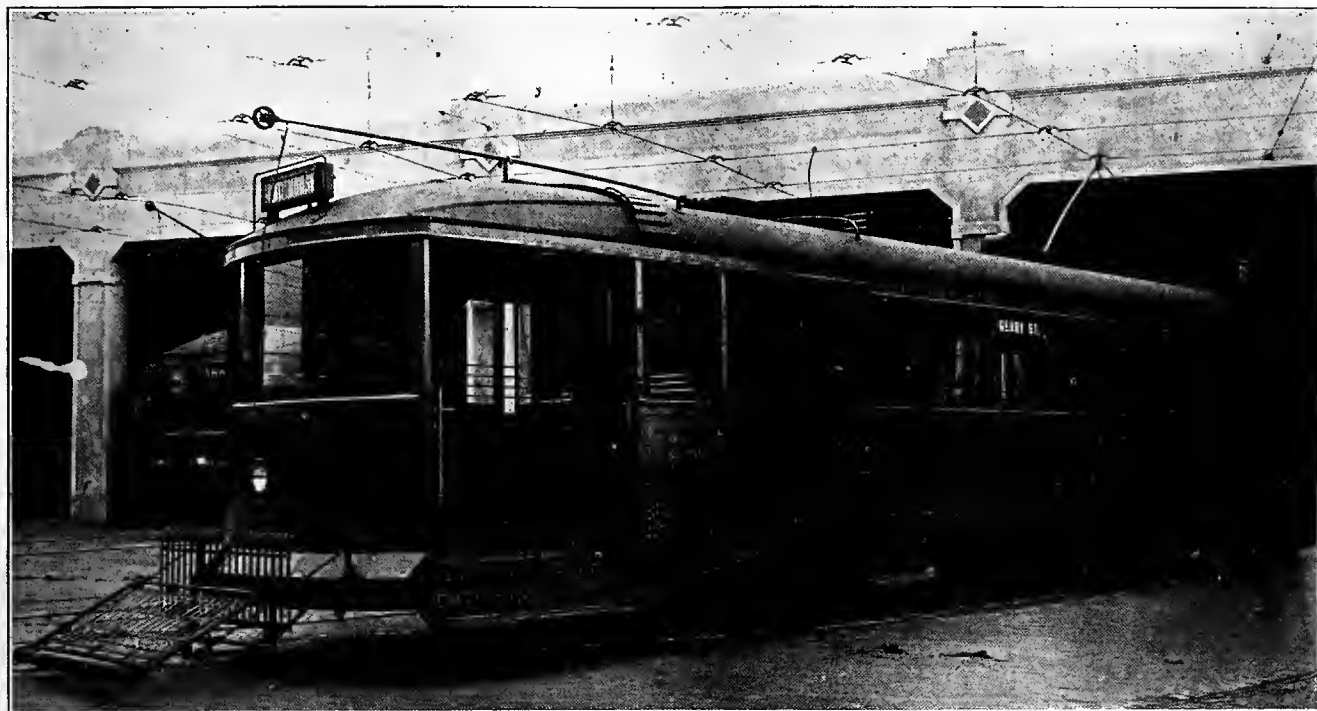
a penalty for interrupted service. A total of 20 minutes interruption in 24 hours penalizes the company to the extent of all the current consumed during that day. An aggregate of one hour of interruptions during any 24 hour penalizes the company to the extent of a whole week's revenue, while an aggregate of 3 hours interruption in a day gives the city the privilege of cancelling the contract at any time they see fit without any objection on the company's part. So far, the company has maintained its service most admirably and every one has been well pleased.

There has always been more or less objection to the use of unsightly overhead feed cables. They are heavy and a possible source of trouble at any time, being especially dangerous in case of fire. The city, in order to do away with this unsightly overhead work, has placed all of the feed cables on Geary street east of Presidio avenue underground, and are placing all of the feeder cables on Van Ness avenue and east and on Potrero avenue and Eleventh street underground.

This has necessitated the building of underground conduits in connection with the track and the installation of risers at points where connection is made between the underground cables and the trolley wires. The underground conduit on the Geary street line consists of multiple clay conduits encased in concrete. All of the new conduits are being laid with fiber conduit, 217,130 ft. being ordered for this work. This includes only the conduit running parallel to the railway tracks. Where it was necessary to make a connection to the station of the Pacific Gas & Electric Company, the conduit connecting the railway with the station has been furnished by the electric company. The municipal railway, however, is furnishing the

in the habit of reading on the street car will appreciate that this means that you can have sufficient light to read your newspaper on the way home in the evening without being able to follow the operation of the car controller by the intensity of the light. This also means a considerable saving in power.

The Geary street line at the present time is consuming approximately 4.2 kilowatt hours per car mile, notwithstanding the fact that there are a number of quite heavy grades on the line and frequent stops. This consumption is considerably less than that of the United Railroads, no doubt due to the long distances over which they feed. In the conduits of the municipal railway sufficient space has been provided for the



Cars at Municipal Car Barn.

cable which goes into this conduit. This in itself amounts to 57,000 lineal feet.

The underground conductors in the conduits parallel to the railway total almost 40,000 lineal feet. These cables vary in size between 250,000 c.m. and 1,000,000 c.m. All positive cables are insulated with 5/32 inch of paper covered with a lead sheath. The negative cables are double-braid weatherproof, the largest of these being 2,000,000 c.m. in size. One heavy run of negative return goes across the Exposition grounds at Buchanan street and consists of almost 7,000,000 c.m. in the form of second hand Edison tubes.

In calculating the size of feeders required, the average number of cars was considered, allowing a drop of 100 volts at the extreme end of the section. This, however, does not cover the exact conditions, for with a fair load it was found that cables which would carry the maximum load with a drop of not in excess of 100 volts would not be sufficient capacity to carry the amperage without undue heating, so that in most instances where the traffic will be congested the cables are of such capacity as to keep the drop well under 50 volts with maximum load. Those of you who are

transmission cables which may be drawn in when the city secures a source of power of its own and builds the necessary substations.

It would hardly be fair to mention the electric work without saying something about trolley poles. The generally accepted standard of trolley poles in city work is tubular steel. These were employed on the Geary street railway but on the new lines it was decided to use reinforced concrete.

While new to San Francisco, concrete poles are not an untried experiment, having been used for line poles and for the suspension of trolley wires at various places in the East. It was necessary to provide some particular type of construction for the Van Ness avenue poles, this location requiring ornamental poles. The ornamentation of steel poles has not been very successful in San Francisco, due to the fact that the steel rusts badly under the ornament. It is also expensive to maintain the paint in satisfactory condition. It was also the wish that the Van Ness poles, in addition to being ornamental might provide facilities for eventually lighting the street.

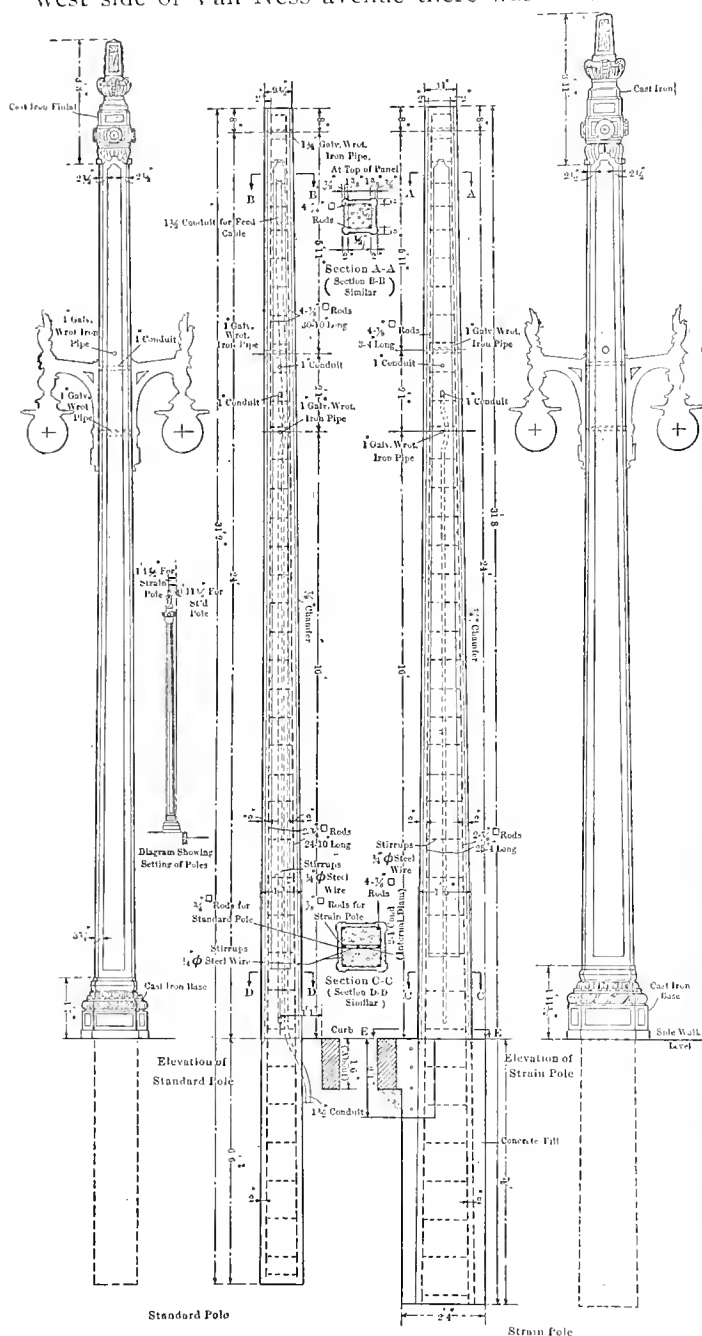
The concrete poles now in place on Van Ness avenue are fully equipped with conduits inside of the pole

and means for attaching cast iron lighting brackets. It is intended that each pole should bear two brackets, lying in a line parallel to the curb, each one of these brackets supporting a 200 c.p. tungsten lamp. The cast iron base, aside from being an ornament, provides space in which terminals may be housed. Along the west side of Van Ness avenue there was laid, in con-

600 volts. The cars weigh approximately 48,000 pounds. This means that the cars are a little heavier motored than any other cars in use in San Francisco. This gives quick acceleration and a good speed on the grades.

The control equipment is also a little different than that in use on western street railways. This equipment consists of remote control apparatus which takes all heavy currents off the platform and reduces the size of the controller, giving more platform space, which is of vital importance to the prepayment type of car. By making some slight changes in the brake equipment and the addition of radial draw-bars and a train cable, this equipment will permit of the cars being operated in trains. This arrangement is being used quite extensively in the East and may be of advantage if the municipal system is extended through the Twin Peaks tunnel.

The air brake equipment is of the straight air type. The new cars have been provided with two additional features consisting of an automatic emergency brake valve and conductor's emergency valves, permitting the conductor to apply the brakes in case of emergency.



Vertical Section of Concrete Trolley and Lighting Pole.

junction with the conduit for the propulsion current, such duct as was necessary to handle the lighting cables. These ducts are all connected into the poles. The proposed scheme of lighting would give Van Ness avenue an illumination almost six times as intense as the present gas lamps.

In closing it may not be amiss to say a few words on the motor equipment of the new cars. Each car of both the Geary street line and the new cars is equipped with four motors rated at 60 h.p. when supplied with



Concrete Trolley Pole.

It has not been the intention of the city engineer to produce anything which would be an innovation in electric railway work. For this reason nothing startlingly new is to be mentioned in connection with the municipal railways but we feel that no one can gainsay that San Francisco has secured a modern system employing the best methods of construction known.

Careful records have been made of the cost of doing the work and it is believed that our figures compare very favorably with those for similar classes of work done by corporations in all parts of the country. San Francisco may, therefore, be justly proud of the fact that she is doing a large job quickly, doing it as well as it is possible to do it, and at the same time doing it as cheaply as anyone could do it.

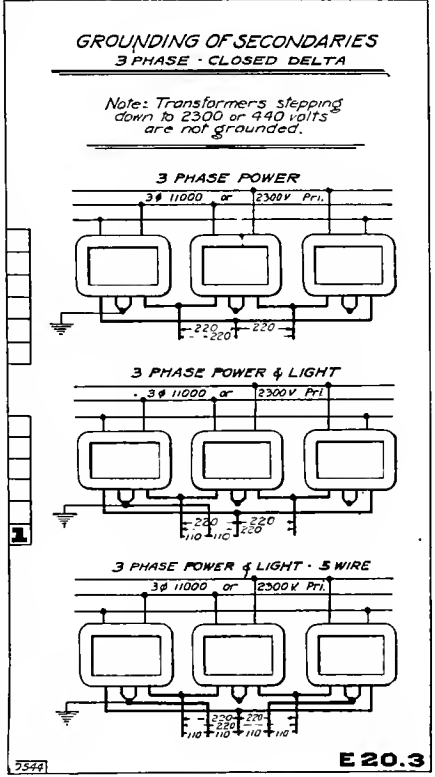
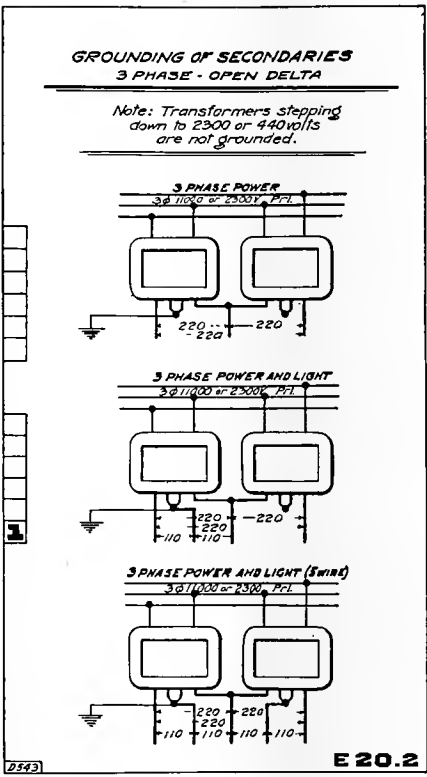
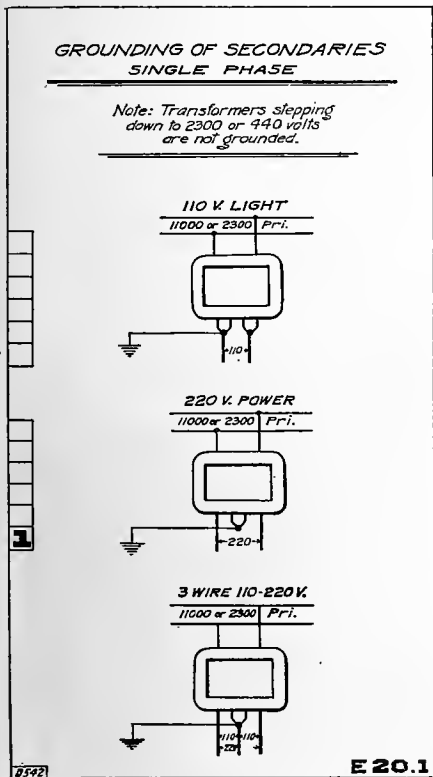
ELECTRIC DISTRIBUTION
STANDARDS AT SAN DIEGO.

E. Transformers.
BY L. M. KLAUBER.
[Continued.]

E 20: Grounding. The three sheets in this section show the connections used in grounding secondaries to comply with the N. E. Code. For the method of grounding see sheet D 90.1. In delta or open delta connected secondaries, where the neutral of the system is not available, the grounding of the middle point of

one transformer is preferred to grounding one of the line wires, since by this means the maximum voltage to ground is reduced from 220 to 190 volts.

E 30: Fuses for Transformers. Transformers having 2300 volt primaries are fused for approximately twice rated load; 11,000 volt transformers for about 50



**TABLE OF
PRIMARY FUSES
FOR TRANSFORMERS**

2300 VOLTS

Size of Trans. in K.W.	Size of Fuse in Amperes		
	Single Phase	Open Delta Outside Leads	Closed Delta Middle Lead
1	1	1	1
3	3	3	3
5	5	5	5
7½	10	10	10
10	10	10	15
15	15	15	20
20	15	15	25
25	20	20	30
30	25	25	40
40	30	30	60
50	40	40	60

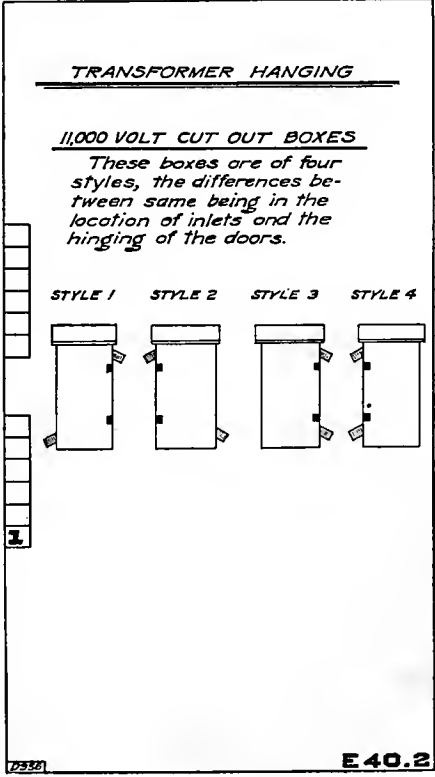
E 30.1

**TABLE OF
PRIMARY FUSES
FOR TRANSFORMERS**

11000 VOLTS

Size of Trans. in K.W.	Size of Fuse in Amperes		
	Single Phase	Open Delta Outside Leads	Closed Delta Middle Lead
1	1	1	1
2½	1	1	1
5	1	1	1
7½	1	1	2
10	2	2	2
15	2	2	3
20	3	3	3
25	3	3	5
30	5	5	5
50	8	8	10
75	10	10	12
100	15	15	20

E 30.2



per cent overload. It will be noted that the middle lead of the open delta banks is sometimes fused slightly higher than the outside leads. This is done in order that outside fuses will blow first on overload, thus completely cutting out a transformer rather than leaving two in series across the line.

E 40.1: Sketches for Hanging. The sketches shown apply to single phase 2300 or 11,000 volt transformers of 50 k.v.a. or less, and open delta banks of 30 k.v.a. or less. For banks of larger transformers two-pole transformer racks are built. These are known

as Class A or B substations; the former has a 10 ft. x 20 ft. platform surrounded by a railing for the convenience of trouble men, while the latter contains foot-boards only.

E 40: Transformer Arm Positions.

The following gives the spacing of transformer arms in connection with standard spacing of primary and secondary arms:

2300 and 440 Volt Primary

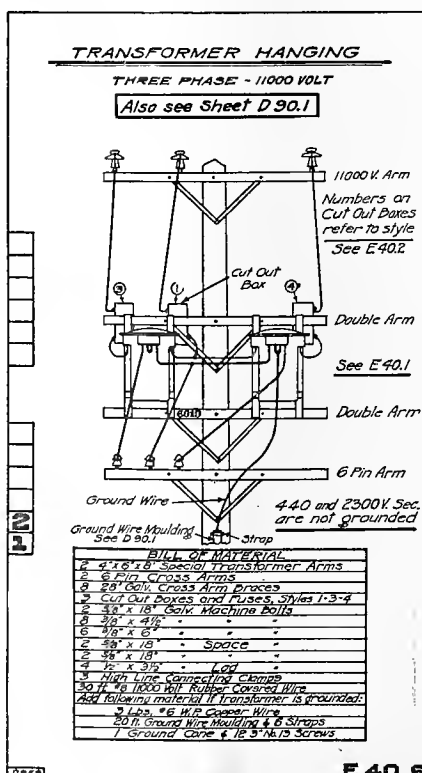
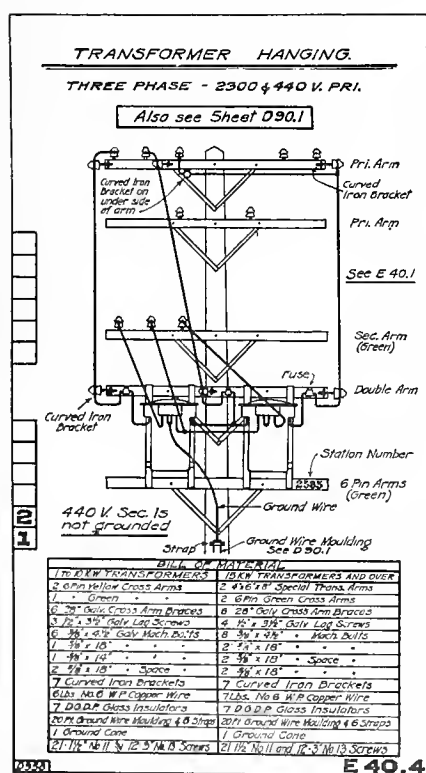
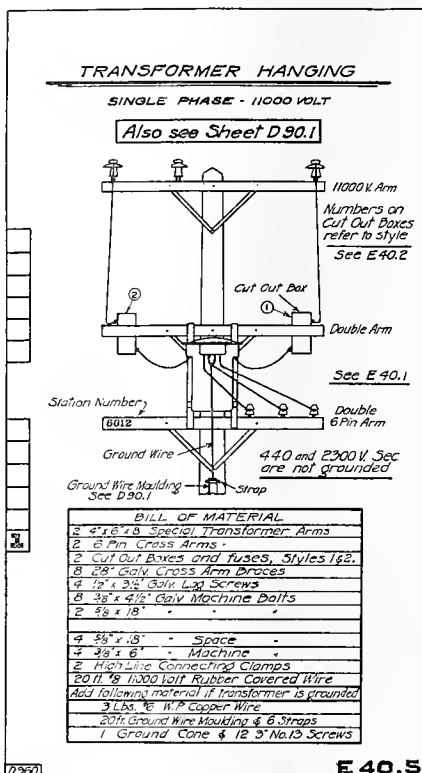
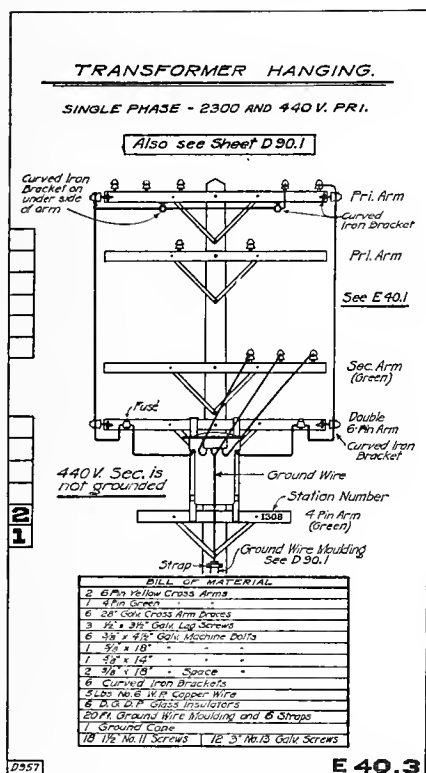
One secondary and two primary arms on transformer pole—On 40 ft. poles the transformer arm is placed 2 ft. below the secondary arm. On 35 ft. poles transformers are hung directly on the secondary arm instead of on a separate arm. On 45 ft. poles and over the transformers arm is placed 6 ft. below secondary arm.

One secondary arm and one primary arm on transformer pole—On 40 ft. poles the transformer arm is placed 4 ft. below the secondary arm. On 35 ft. poles the transformer arm is placed 2 ft. below the secondary arm. On 45 ft. poles and over the transformer arm is placed 6 ft. below the secondary arm.

11,000 Volt Primary.

On 40 ft. poles the transformer arms are placed 4 ft. below the 11,000 volt arm; on 45 ft. poles, 7 ft.; and on 50 ft. poles, 10 ft.

The notes on transformer hanging do not represent hard and fast rules. The construction foreman will use his best judgment to secure the best results, but where no distinct benefit will be derived by deviation from these rules, then they should be followed exactly.



TRANSFORMER WEIGHTS

NET WEIGHTS INCLUDING OIL

SIZE	G.E. TYPE H FORM K 2400V.	G.E. TYPE H FORM K SUBWAY	G.E. TYPE H FORM G 11000V.	WEST. TYPE 3 2400V.	WEST. TYPE 3K 11000 V.
1	120			90	
2.5			365		340
3	215			170	
5	300	365	465	260	460
7.5	410	450	425	350	485
10	480	505	450	445	485
15	725	855	765	600	690
20	885	975	860	800	870
25	1105	1140	1260	960	1000
30	1235	1295	1245	980	1170
40	1470	1825	1315		
50	1835	1955	1560	1740	1740
75	2430	2025	1905	2150	2590
100	2685	2465	2910	2400	2775
125	2830		3165		
150	3050		3600		
200	3520		4410		

E 50.1

PUBLIC POLICY OF PUBLIC UTILITY CORPORATIONS

DUPLICATION BY MUNICIPAL UTILITIES.

BY GEO. A. LEE.

(After illustrating the absurdity of duplicate utilities and the injustice of unregulated municipal competition, the author justifies a rate higher than the banking rate. This paper is a transcript from discussion on F. T. Post's "Public Policy" paper published in these columns September 26, and has not been corrected by Mr. Lee. Mr. Lee was formerly chairman of the Washington Public Service Commission.—The Editor.)

Upon entering the public service commission, I undertook to make an analytical study of the public policy problem from a legal and financial viewpoint. One of the first conclusions I reached was the economic absurdity of a duplication of public utilities, as has been confirmed by several instances in Washington. At Ellensburg a reasonably efficient water system was duplicated by the municipality, at a cost of about \$250,000. Ellensburg, as you know, is a small community. Not long ago a similar duplication occurred in Centralia. That duplication is now being agitated in Raymond, South Bend, and other communities.

Now, whether you be layman or lawyer, public utility operator or patron, it is important that you as people of the State stop and consider this situation. It seems to me that in this western community, where we need, more than anything else, the development of our natural resources and the extension of public service power we may well consider and study this problem from an advised viewpoint. Duplication means an absolute waste of capital. If the city of Ellensburg is able to serve a community of thirty thousand and the Public Service Commission requires that it do serve that number, which it has done reasonably and sufficiently, then does it not stand to reason that \$200,000 sunk in a duplicate plant means a loss of capital?

In a small community it is impossible for two competing public utility plants to exist. Either there will be a rate war until the two are destroyed, or the one must absorb the other and then boost its rates until the one makes up for the deficiency of the other. There isn't any question about the financial soundness of that argument. Read the expressions of the best courts and commissions in the last twelve months, and you will find that these courts and commissions—regardless of shades of thought and difference in political views, all take the unanimous stand—that the time has come when that condition must stop. If that is true in other states, why can it not be equally true in Washington? Why must the men who put in thousands of dollars, furnishing us with the luxuries of life and waiting until their patronage is big enough to give them a fair return on their investment, be deprived of the benefits? It seems to me a fundamental principle that doesn't require any argument.

It is another subject to teach the people. I think it is time for every public utility man to lay the matter on the table. Their books are open to inspection. They can no longer grab, even if they so desire, and if that is true, with all the elaborate accountings re-

quired by the Public Service Commission, it seems to me the public service corporations may approach their legislature and ask them to consider the enactment of some such protective legislation as has been suggested.

There is another matter upon which reasonable men may differ, and that is the question of regulation and control of municipal utilities. I believe—as do others, that it is unjust and unreasonable. As Mr. Post has so admirably expressed, it is unfair and unreasonable to permit indiscriminate freedom to municipal utilities and then deny it to others.

The constitution of this state guarantees a certain measure of home-rule, and if the municipalities are entirely free to control their properties, so should the corporations be.

Some time ago the Seattle Telephone Company was giving inadequate service. Some of the patrons approached the Public Service Commission and asked that the rates be raised and the service improved. That is probably the one time on record that such a request has been made to the commission, basing their request on the argument that the rates were inadequate for good service. The commission entered into an extended inquiry, and an appraisal of the telephone company's property, and found that under the schedule fixed for the various branches the company was getting a poor return upon its investment. Therefore, the commission ordered a new schedule of rates which exceeded the maximum rates fixed in the company's contract. The city of Seattle said that was "unlawful." The Supreme Court of the state sustained the commission and held that the police power of the state was paramount to the city, and that when once exercised should control. That finally established the law in this state and jurisdiction with reference to police control. A great many citizens raised a hue and cry against the company and against the commission. These same critics forgot that in many cases in the past, and probably in some future time they will approach this same commission and allege that the minimum rates are too high, and the commission, after investigation, may so find, and you will never hear any criticism. That established conclusively limitations upon that home-rule clause in the constitution.

The law forbids discrimination. It requires uniformity in rates. It imposes many other requirements. A privately owned plant might have come into the city of Spokane (say twenty-five years ago), made an investment of a million dollars, given light and power to the people, and developed eastern Washington. It might have been content to wait many years (during the so-called lean period) before it received a return upon an investment; the period passes and it is about to make a reasonable profit upon its investment; it complies with all the laws, and lays its cards on the table. About that time agitation is started for municipal plants, and what is the result? The municipal plant is built and is not regulated by the same law as the privately owned plant. You must either place them on the same basis or else eliminate

regulation altogether. That is bound to come about within the next five years.

When I was on the commission many of the people who advocated home rule came to the commission and suggested that they intended to ask the legislature to deprive the commission of all control over companies in cities of the first class. We then told them that it would greatly relieve our duties, but that in justice to the oath of office we had taken we could not consent to that program. But, we said, if you will discuss the matter with us we may be able to arrive at some line of demarcation where our ideas may coincide. But they rejected it, and said we will take the matter to the legislature. We said we will also present our side. As a result the movement was defeated.

As business men, as taxpayers, as men not only interested in your own properties but in the matter of this country's welfare, it behooves you to educate yourselves upon this important problem, and transmit your conclusions to those who represent you in the legislature.

In concluding, it occurs to me that it might be of interest for a moment to indicate what I consider a more reasonable tendency upon the part of the court. Some years ago in the famous case of Callington vs. The Turn Pike Company, the Supreme Court of the United States announced that it was not necessary for a public service company to make anything on its investment. The court said if the value of the service was not worth any more to a certain patron that rate might be held to be controlling. I find the state courts, as well as the federal courts have now come to the conclusion that unless a public service corporation is denied the right and privilege of earning a lesser rate than banking rates it constitutes a confiscation. The mere fact that a schedule of rates just escapes the rates of confiscation does not mean that the schedule of rates is inherently correct. A public service commission, sitting upon a given case, might find that if the company were permitted to earn six per cent the property might not be confiscated, yet they might find that 6 per cent was not a reasonable schedule. The commissions of this country ought not, in the language of the Supreme Court of Wisconsin, try to scale down to the very limit the rates of the public service corporations to escape the rates of confiscation. They ought to be given not less than the banking rates of the community. Yesterday, on a case at Newport, it was established that the earnings of the company had fluctuated over the years of 1912-13, and that in case prohibition carries sixteen per cent of the revenue may be wiped out. This is one of the occurrences incident to the operation of a business of this character, and which justifies a higher rate than the banking rates; otherwise, the state will remain undeveloped.

Conversely, when the public service company reaches a point where it is stable in the community, where it can pay all its fixed charges, and make the banking rate upon its investment, then every public utility operator will be willing to accept that lesser rate. But until that time does come and until that patronage has a non-fluctuating policy, incentive for managerial efficiency is destroyed.

PUBLIC ENEMIES.

If you build a line of railway over hills and barren lands,
Giving lucrative employment to about a million hands;
If you cause a score of cities by your right-of-way to rise,
Where there formerly was nothing but some rattlesnakes and
flies;

If when bringing kale to others you acquire a little kale,
Then you've surely robbed the peepul and you ought to be in
jail.

If by planning and by toiling you have won some wealth and
fame,

It will make no odds how squarely you have played your little
game;

Your success is proof sufficient that you are a public foe—
You're a soulless malefactor; to the dump you ought to go.
It's a crime for you to prosper where so many others fail;
You have surely robbed the peepul, and you ought to be in jail.

Be a chronic politician, deal in superheated air;
Roast the banks and money barons, there is always safety
there;

But to sound the note of business is a crime so mean and base,
That a fellow guilty of it ought to go and hide his face.

Change the builders' song triumphant for the politicians' wail,
Or we'll think you've robbed the peepul and we'll pack you off
to jail.
—Walt Mason.

The nitrogen lamp, or gas filled metallic filament lamp as it is now denominated, is available in 200 to 1000 watt sizes at 105 to 125 volts. More than half its luminous flux is of a daylight color. The lamp requires a heavy initial current, approximating twice its steady value for about one-twentieth of a second.

The telescribe is a recent invention of Thomas A. Edison consisting of an Edison dictating machine arranged to record both sides of a telephonic conversation. It should be of particular value to brokers and others conducting important business over the telephone, where a record has heretofore not been possible.

Electric production of ferro-manganese has been started on a large scale in the electric furnaces of the Noble Electric Steel Company at Heroult, Shasta county, Cal. One furnace is in operation with a daily output of 15 tons and other furnaces are being rushed to completion to meet the demand from the steel mills which has ensued since the curtailment of European supply.

Time saved by the Panama Canal, in the case of the "Pleiades" which sailed from San Francisco July 27, and reached New York August 26, amounted to just half that usually occupied in the trip around the Horn. During the past week a vessel arrived in San Francisco Bay from Holland via the Panama Canal in just 31 days. Incidentally it carried a large shipment of tungsten lamps.

Aluminum nitride is a synthetic substance obtained by the utilization of atmospheric nitrogen, being based on the fact that aluminum can be caused to absorb nitrogen under the influence of an electric current. This process requires one-eighth the current necessary in the Birkland-Eyde process and less than one-half that in the cyanamide process to obtain equal weights of "fixed" nitrogen. A French company is making commercial application of this process.



LIGHTING METHODS



ARC LAMP PHOTOMETRY.

BY FORD W. HARRIS.

(After a statement of the difficulties of arc photometry and the causes therefor, the paper gives practical directions and precautions to be used in testing arc lamps. The author is a consulting engineer at Los Angeles.—The Editor.)

A great deal has been written about photometry in general, and about arc lamp photometry in particular, and there are many published distribution curves of particular types of lamps burning particular carbons. To the average engineer familiar only with incandescent lamp photometry these curves are quite convincing and they are generally accepted as correct by those interested. Arc lamp photometry, however, is radically different from incandescent lamp photometry, and any results obtained must be interpreted in the light of these differences. It is the purpose of this paper to point out what these differences are, to explain what must be guarded against in testing arc lamps, and to point out in a broad way the best methods of testing such lamps both in the laboratory and in the field.

In the first place it should be recognized that in dealing with the question of light from an arc lamp we are dealing with a most variable quantity. In testing incandescent lamps under constant voltage conditions we have a constant source of light, and can get accurate results if we understand our business and have a satisfactory photometer. No such accuracy in a single reading is possible in arc lamp testing. The total light emitted from the lamp varies instantaneously over wide limits, and there is superimposed on this total variation instantaneous variations in the shape of the distribution curve, so that the light thrown on a unit surface varies erratically. The eye, due to the natural persistence of vision, tends to integrate these variations and the judgment of the operator may be exercised to strike an average, but the results are generally unsatisfactory. A general average may be found which will probably be correct within 10 per cent for the particular conditions under which the lamp is operating when tested, provided proper precautions are observed.

The light emitted from the lamp, however, will vary widely, quite apart from the instantaneous jumps previously mentioned, during the life of a pair of electrodes, and the average light given by one pair of electrodes may vary widely from another even when these electrodes are commercially identical. This is particularly true of electrodes depending on titanium or iron for their luminous properties, such as are commonly used in the magnetite or metallic flame lamps. This variation in electrodes can be easily exaggerated if desired in mixing samples, as in such electrodes light is often sacrificed for reliability or life, the electrodes giving a high luminosity being likely to be unsteady, short lived, and often giving trouble due to slagging. It should be borne in mind that any arc is a variable quantity, jumping about for no apparent reason, easily

affected by drafts or stray magnetic fields, and that the electrodes, being composite bodies imperfectly mixed, cause instantaneous variation in the material fed into the arc. When the light is thrown on the photometer screen these variations are magnified, and the result is an unsatisfactory series of readings. In addition to all this there is the question of color variation and the human equation which is modified by both the question of the judgment and the peculiarities of vision of the operator.

It is comparatively easy with a good arc lamp photometer to take a set of readings from which a distribution curve can be plotted, and it will not take over an hour to do so with a conveniently arranged photometer. If, however, the electrodes are changed and a second curve is taken the next day by a different operator the chances are that the results will differ both as to the total light and its distribution. It is possible, however, by taking suitable precautions to get close results in arc lamp work and the methods to be employed will now be described. Much of the knowledge acquired in ordinary photometry is applicable to arc lamps, but this will be referred to only briefly and in such a connection as will be necessary to understand the peculiar nature of the arc lamp problem.

As we are dealing with a variable, and all our results are somewhat approximate, it is unnecessary to go to any great refinement in our photometer proper. While the Lummer Brodhun screen is accurate when applied to incandescent lamp testing, it is really unnecessarily so when applied to arc lamp testing, and it is probable that an ordinary Bunsen grease spot will serve the purpose quite as well. The standard lamp should of course be accurate, and it is best to use it only for checking secondary standards which are used for the actual testing. The supply voltage for the standard lamp must be steady, preferably being furnished by adequate storage batteries in good repair.

In an arc lamp, and in general in any luminous source, we desire to know both the total light and its distribution.

My method of testing lamps is to determine as accurately as possible the shape of the distribution curve quite apart from the luminous intensity, then to determine the intensity at a certain angle, and finally to find the average total light over a long period.

The shape of the distribution curve can best be worked out in a distribution photometer in which a fixed screen is placed in a certain relation to the lamp to be tested, and the position of the standard lamp with relation to the screen varied until a balance is struck. The screen is shielded from the direct rays of the arc and a pair of mirrors are turned to the various angles desired. Such a photometer is shown in Fig. 1. In these figures the arc lamp is hung from a suitable support. A pivoted arm is provided with adjustable mirrors and turns about a shaft carried on the same support. This shaft is on the photometric

axis which passes through the arc, and upon which the sight box and the standard lamp are also placed. A metal disc, having a plurality of holes about its outer edge, is also secured to the main support, these holes being preferably every ten degrees apart, and so placed that they are entered by pins sliding in the ends of the arms, and by which the arms may be secured in any angular position. A screen is hung alongside the arc lamp to screen the sight box from the direct rays from the lamp.

The photometer proper consists of a table having metal strips secured thereto and forming the track for a truck which carries the standard lamp and a

angular position. The result will be ten dots in a straight line on the paper. The angle read is then marked on this line and the roller is turned and a second set of readings is taken. This procedure is followed until ten readings are taken at each angle. The center of each set of ten is then determined and this may be considered as a mean. At least ten such means should be determined and the average used to plot a distribution curve in any convenient units.

Ordinarily in photometric work care is taken in calibrating the apparatus to determine the exact quantity of illumination at each point. In finding the shape of the distribution curve this is not necessary, as rela-

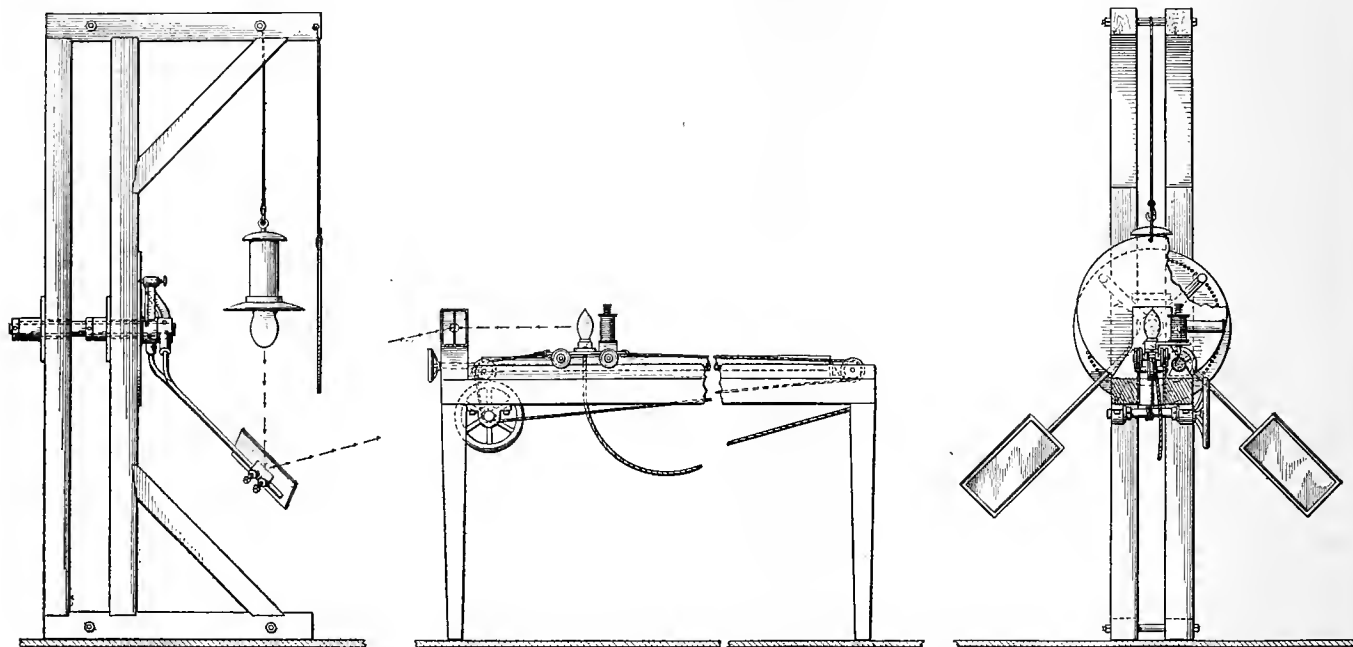


Fig. 1. Arc Lamp Photometer.

recording magnet, the lamp and magnet being fed through a flexible cord. A handwheel is provided which pulls the truck back and forth by means of a cord which passes over suitable pulleys and connects to either end of the truck. A soft wooden roller is mounted in suitable bearings on the table and is turned by a handwheel. A sight box is placed on the table in the photometric axis.

This photometer is designed to give a series of quick readings, a scale being marked on one of the metal strips. The method of using is as follows: The parts being assembled as shown a strip of paper is secured about the roller by thumb tacks. The operator then sets his mirrors for the angle he wishes to get his reading on and slides the standard back and forth until he gets a balance in the sight box. At the instant he does this he closes the circuit, by a small switch not shown, to the magnet, and a pointed core is pulled down and punches a hole in the paper. He then opens the circuit and the core is thrown up by a spring. The operator then gives the handwheel a turn, destroying his balance and proceeds to establish another, recording it when obtained on the strip of paper as before. About ten readings should be taken before the mirror are shifted to another an-

gular position. The result will be ten dots in a straight line on the paper. The angle read is then marked on this line and the roller is turned and a second set of readings is taken. This procedure is followed until ten readings are taken at each angle. The center of each set of ten is then determined and this may be considered as a mean. At least ten such means should be determined and the average used to plot a distribution curve in any convenient units.

It is now necessary to determine the total light and this is best done in a sphere such as is illustrated in Fig. 2. The lamps are preferably hung on arms, mounted on an axis, six lamps being preferably employed so connected that they can all be burned continuously, any one of them swung into the sphere for a reading. This sphere is formed of two halves like a walnut shell, and has an opening in the top adapted to fit tightly around the lamp casing. This is desirable in testing lamps that give off fumes, as these fumes deposit inside the sphere and destroy its accuracy, unless the chimneys are placed outside. A standard incandescent lamp is placed at any convenient location inside the sphere, and an opening is made in one side thereof through which light is admitted to the photometer. The observer takes readings through the sight tube, the photometer being the standard Sharp-Millar instrument. Various lamps may be compared by such a sphere and close results obtained, the readings being proportional to the total light emitted from the lamp. If such a sphere is considered too expensive, good average results may be obtained in a cube if the corners are filled. The spheres are, however, not very expen-

sive and quite satisfactory. Having obtained the shape of the distribution curve in arbitrary units in the distribution photometer and the total light in the sphere, it is possible, by the use of the Rousseau diagram, to derive an accurate distribution curve from these data.

A preferable way to get such accurate distribution curves, however, is to remove the mirrors and the plate from the distribution photometer and take direct horizontal readings on the arc, determining the average horizontal candle power of one hundred or more readings taken throughout the life of a pair of electrodes. If the horizontal candle power is known and the shape of the curve is known an accurate curve can be readily plotted.

In practice, however valuable the above data may be to the lamp designer, it is of questionable practical value to the user of arc lamps. The real points of merit of an arc lamp can be much more easily deter-

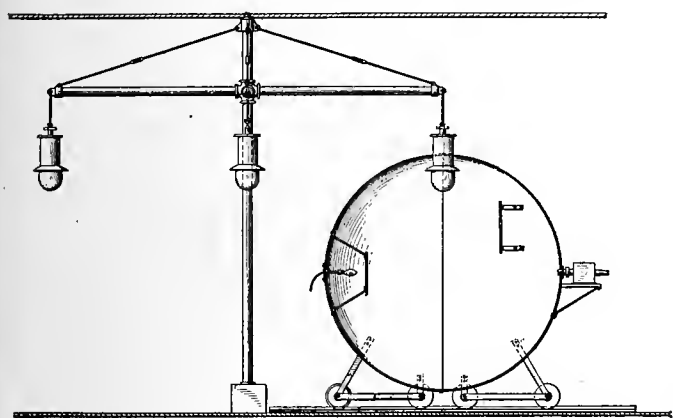


Fig. 2. Sphere for Determining Total Light.

mined by one interested. The two points most interesting to a user is the light emitted at an angle of 15 degrees below the horizontal and the shadows cast. The question of shadows can best be determined by hanging several lamps over plane, evenly-colored surfaces and observing the results. That lamp is the best which throws no shadows, and no amount of distribution curves can effect a practical demonstration of this kind. The light at 15 degrees below the horizontal can be fairly and accurately determined by hanging the lamp in a dark room and setting the Sharp-Millar so that a 15 degree ray is intercepted. One hundred or more readings should be taken and an average struck. If the lamps are hung low 10 degrees may be of more importance and readings may be taken at this value.

The candle power of arc lamps is regularly overestimated by the manufacturers. The ordinary 7 amp. a.c. enclosed arc burning under average conditions gives a maximum of about 300 c.p.; the 4 amp. magnetite between 450 and 600 c.p.; the 6.6 amp. magnetite from 800 to 1200 c.p. depending on the electrodes. The new enclosed impregnated carbon lamps give from 1000 to 3000 c.p. at this angle with 10 amps. 55 volts at the arc again depending on the particular make of carbon and the character of the circuit. It is no secret that the ordinary enclosed a.c. arc is obsolete as a light-giving source and ought to be scrapped. The 4 ampere magnetite is at present the most practical arc lamp for residence street lighting, and the luminous

flame or impregnated carbon arc the most practical for display or business street lighting. It is probable, however, that unless rapid improvements are made in arc lamps that the new nitrogen filled tungstens will largely supersede them.

NITRATES MAY BE PRODUCED IN UNITED STATES.

The European situation has called attention sharply to the dependence of this country upon Germany for its potash supply, some 12 or more million dollars' worth of which is used annually in the United States for fertilizer. Another necessary mineral fertilizer for which the United States is entirely dependent upon a foreign country is sodium nitrate, over 21 million dollars' worth of which was imported from Chile last year.

Deposits of sodium and potassium nitrate are known in Utah, Nevada, California, Oregon, Montana, and New Mexico, and have been described in publications of the Geological Survey and Bureau of Soils, but thus far no material of this kind has been found in sufficient quantity to promise commercial value. The latest report that has come to the Geological Survey relates to a deposit in Arizona.

One important domestic source of combined nitrogen is the gas works and by-product coke ovens, which in 1912 reported a recovery of ammoniacal liquor, ammonia, and ammonium sulphate valued at \$9,519,268. This output of by-product ammonium sulphate increased in 10 years from 17,643,507 pounds to 99,070,777 pounds, and as it is linked with the great coking industry further increases can be expected.

Another domestic supply of nitrogen compounds lies in the fixation of atmospheric nitrogen by electricity. Cheap hydroelectric development is necessary to establish this industry, which would make our large agricultural and industrial interests free from the uncertainties of the foreign supply. It is hoped that the water power legislation now before the United States Senate may promote hydroelectric development in large units and thus utilize some of the great water powers in the West in obtaining nitrogen from the air.

Steam boiler explosions in the United States during the year 1913, totalled 499; 180 persons were killed and 369 injured. Every engineer or other worker in a steam power plant who prizes his life should insist on the use of softened water for his boiler, and on its periodical inspection and cleaning.

Phosphates in Idaho is the subject of a recent bulletin from the U. S. Geological Survey. An estimate of the high-grade phosphate rock available in the area northeast of Georgetown is 2,663,290,000 long tons. Positive information about the character of the deposits at greater depth is needed, since all the data collected at present have come practically from the outcrop. The importance of the phosphate deposits still in public ownership is greatly enhanced by this estimate, even if only the outcrop of these deposits is of present commercial value. It is considered advisable, however, that a study of the quality of the deposits lower down should be made by systematic drilling prior to their disposal and development.

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San Francisco has good reason to be proud of the municipal electric railway system described in this issue. Built to meet an urgent demand for service which could not be supplied by private capital because of prohibitive restrictions, the system stands as a monument to the efficiency of the engineering department of the city.

These railway lines were needed to provide adequate transportation to the Exposition, whose success was largely dependent upon their immediate construction. Private capital could not or would not, build them. So it became a duty for the municipality to assume the responsibility, quite apart from any direct profit or benefit which have fortuitously resulted because of their strategic position along present trade arteries.

One criterion in determining the limits to which municipal ownership should be extended is the indispensability of the utility, whether it can be spared in the economic life of the city. The city should own and control those factors which are vitally essential to the lives of its citizens. Police and fire protection, sewers, streets and schools come under this category. As cities become larger and life more complex former luxuries become actual necessities. In fact civilization is largely a process of transforming luxuries into conveniences and conveniences into necessities. The luxuries have been developed by specialized technical knowledge and private capital. As the knowledge becomes more general and the requisite skill becomes less, it is possible for less specialized organizations to carry on the work.

Urban transportation in Western communities is in the twilight zone between the indispensable and the dispensable utility. Modern city life is not possible without water, and consequently a water system is indispensable. Candles or lamps are a possible substitute for gas or electric lighting, so they may be classified as dispensable. While walking or bus service is possible in case the street cars fail to run, the larger the city the more unsatisfactory the substitute. Therefore ownership of a street railway may now be logically considered a proper function of a large city. By inference, also, the continued development of gas and electric lighting makes it merely a matter of time until they will become so indispensable to our life as to make municipal ownership advisable. Such a millennium, however, has not yet arrived.

This editorial is calculated to be a fair and unbiased statement of the eventual. But while an enterprising manufacturer of flour has given wide publicity to the slogan "eventually—why not now?" there are many good reasons for not treading too closely upon the heels of progress. Electrical development is still too highly specialized to be yet safely placed in the hands of amateurs.

Nor does municipal ownership necessarily mean municipal operation. It is difficult, for instance, to

assure the continuance of such integrity of management as has characterized the construction of San Francisco's municipal railway. "To the victors belong the spoils" is always the motto of politicians. Too often do government office-holders adopt the mental attitude that they have worked hard enough to get their job and been put to such an expense, that they consequently have little incentive to give proper service to the public who employs them.

For several years this journal has consistently recognized that municipal ownership of public utilities is inevitable and has as constantly urged that private operation is advisable. Better service can be given at lower rates under the efficient management of a private operating company than by any political system yet devised.

At this time also a word of warning should be incorporated with the commendation of San Francisco's enterprise. There is every likelihood that the property of the United Railways will be acquired by the municipality sooner or later. This company's enforced policy of limiting unprofitable extensions, has roused the antagonism of many real estate speculators who will be the first to urge expansion of a politically controlled street railways system. Unless these extensions be made with great care and judgment, profits will be transposed to deficits. While these remarks are specific in illustration they are general in application.

Electrical men are a unit in recognizing the need for a wider popular understanding of the how and why of electricity and its application. Most discussions regarding electrical subjects are couched in language which the layman does not understand. To correct this undesirable state of affairs two alternatives are open. One is to continue to patiently educate the public about the meaning of electrical terms; the other is to translate these electrical terms into the every day language of the average man. While there is great need for educating the public about electricity there is a greater need for educating the electrical engineer about simpler means of expressing his ideas.

Most of the facts and theories of electricity can be stated in language so simple that a child can understand them. Just as the clown must be the smartest man in the circus, so is the simple writer or lecturer the man who best knows his subject. The books that have lived through the ages are the books within the understanding of the people.

Because electrical facts and theories were first developed largely by the aid of mathematics a scientist seldom has the daring originality to depart from the mathematical formalism which has thus become intimately associated with electricity. Few men understand the intricacies of higher mathematics. What a man can not understand he is likely to fear. So

men are suspicious and fearful of electrical facts expressed in mathematical terms.

This in no measure is intended to discount the value of mathematics in the study of electricity. Without the aid of this powerful tool present day knowledge would not have been possible, but its future use requires brains and not the mere mechanical ability of an automaton.

At last the mathematicians themselves are beginning to recognize that the calculus, for example, is a mass of meaningless letters and formulae to the average student largely because the teachers have slavishly clung to the abstract and conventional treatment which commonly divorces the subject from common-sense and everyday experience. They have endeavored to make mathematics the end, rather than the means to an end, and in so doing have defeated their own purpose.

A recent meeting of the Society for the Promotion of Engineering Education was deeply concerned with this problem. A strong appeal was made for a better realization of the physical reality which a mathematical process symbolizes. A differential is not merely a symbol of operation, but a definite, concrete geometrical magnitude, the tangent of an angle. In physical experience it represents a rate of change. Professor Hedrick of the University of Missouri stated many of the results of the calculus in a form which requires no previous mathematical training and employs no symbols except English words, all based on this conception of rate of change, whether of time, temperature or any other basal factor.

Now that such an example has been set, it is high time for electrical engineers to do likewise. The ability to use mathematical short-hand in their own studies should not prevent an interpretation for the benefit of others.

What this world needs, above all else, are interpreters. Since the time that Joseph interpreted the dreams of a Pharaoh until Steinmetz interpreted his own visions, interpretation has ever been rewarded as the highest type of electric service. Any systematic effort to educate the people about electrical matters should be preceded by and based upon a simplification of electrical terms. This is a work which calls for the attention of the biggest brains in the industry.

The usual electrical text book consists largely of symbols. Symbols have always been used since the earliest times to transmit ideas. The truths of the ancient mysteries were communicated to the initiated and concealed from the uninitiated by means of symbols. Thus a symbol usually embodies as much concealment as revealment. In ancient times ignorant people worshiped the symbol, rather than the principle symbolized. In modern times we have an idolatry of mathematics, rather than of the physical ideas which mathematics symbolizes. Let us therefore simplify our symbols.

Simpler Symbols

PERSONALS

G. C. Green, manager Fairbanks, Morse & Co. at San Francisco, is making a trip throughout the San Joaquin Valley.

Eldon Beal, superintendent of construction for the Northwestern Electric Company, of Portland, Ore., is at San Francisco.

W. D. Gilroy, has succeeded **S. L. Cook**, resigned, as manager of the Kootenay Lines, Ltd., the telephone company at Nelson, B. C.

H. V. Carter, president Pacific States Electric Company, San Francisco, left for a trip to Portland and the Northwest the first of the week.

A. J. Myers, Pacific Coast manager Wagner Electric Manufacturing Company, is making a business trip throughout the southern part of California.

A. V. Olsen, representative Pass & Seymour, at San Francisco, has returned from a short pleasure trip throughout the San Joaquin Valley.

John P. Coughlan, attorney for the Pacific Gas & Electric Company at San Francisco, has been appointed receiver for the Northern Electric Railway.

G. H. Moore, electrical engineer with the city engineer's office at Seattle, is directing surveys of power sites in the Olympic Mountains, Washington.

William Strohman, eastern representative Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., is a recent arrival at San Francisco.

C. F. Conn, assistant Pacific Coast manager J. G. White Engineering Corporation, has left San Francisco for the East on business, where he expects to stay about three weeks.

R. H. Gaud, manager of the electric lighting and transportation interests of the Southern California Edison company at Santa Barbara is a recent visitor in San Francisco.

J. H. McCarthy, formerly with the Electric Appliance Company, has recently joined the forces of the Electric Railway & Manufacturing Supply Company of San Francisco.

Ira J. Francis, manager of the Southern California branch of the John A. Roebling Sons Co., has returned to Los Angeles from a trip to the Trenton factory by the way of the Panama Canal.

S. Z. Mitchell, president Electric Bond & Share Company, is in Salt Lake City in connection with the business of transferring the property of the Utah Light & Railway Company to the Utah Light & Traction Company.

W. M. Carpenter, vice-president and general manager American Cross-Arm Company of Chicago, is a recent business visitor in San Francisco. He leaves for Los Angeles where he expects to stay for a week or ten days before returning to Chicago.

H. H. Cudmore, director of the Mazda Bureau of General Electric Company, expects to leave San Francisco this week for the East, attending the annual congress of the Jovian Order at St. Louis enroute. He plans to return about the first of November.

E. F. Dunlap, electrical inspector at Portland, has returned from an extensive western trip in the course of which he examined the requirements for electrical wiring at Seattle, Tacoma, Spokane, Minneapolis, St. Paul, Chicago, Kansas City and Denver.

D. W. Henderson, superintendent of transportation, and **E. A. Batwell**, publicity agent for the Puget Sound Traction, Light & Power Company, have left Seattle to attend the annual convention of the American Electric Railway Association at Atlantic City.

L. E. Hanchett was re-elected chairman of the board at the annual meeting of the stockholders of the Northern Elec-

tric Railway, also **Leon Sloss**, president; **P. T. Morgan**, **J. D. McKee**, **J. S. Drum**, **Louis Sloss** and **W. P. Hammon** were re-elected as directors.

W. L. Overman, special representative of the Hughes Electric Heating Company of Chicago, Ill., has an exhibit at the Alameda County Exhibition and Carnival at Idora Park in Oakland, with the Piedmont Electric Company, demonstrating electric heating devices.

C. N. Black, vice-president and general manager United Railroads of San Francisco has left for Atlantic City to attend the annual convention of the American Electric Railways Association of which he is president. The 1915 convention will be held in San Francisco.

K. E. Van Kuran, assistant district manager of the Southern California office of the Westinghouse Electric & Manufacturing Company, has returned from a trip East, during which he attended the managers' convention at Hot Springs and visited the factories at Pittsburgh.

D. E. White has been transferred from the Pittsburg office of the Westinghouse Electric & Manufacturing Company to act as railway specialist at the Seattle office, succeeding **K. A. Schaller**, who recently resigned to become superintendent of the St. Paul & Southern Railway.

Philip Hamlin has resigned as vice-president of the Mountain States Telephone Company, Denver, Colorado to take charge of the Interstate Utilities Company which has absorbed the North Idaho Telephone Company and other telephone interests in northern Idaho. Offices will be maintained at Spokane.

W. S. Heger, Jr., who left for St. Louis last month to be present at the assembling and tests of the great engine the Busch-Sulzer Bros. Diesel Engine Company are to install at the Panama-Pacific Exposition, has returned to San Francisco and reports that the tests were a great success, and that the factory is running day and night.

J. G. Barber was elected president of the Yosemite Power Company at the recent annual meeting held in San Francisco. The company has been reorganized and the new officers are: **F. G. Hamilton**, first vice-president; **E. A. Wiltsee**, second vice-president; **P. M. Langan**, treasurer and controller—directors, the foregoing and **Albert Raymond**.

Henry Bosch Jr. has resigned as chief draughtsman for the department of electrical and mechanical engineering of the Panama-Pacific International Exposition to join the engineering department of the Pacific Gas & Electric Company at San Francisco, under **J. P. Jollyman**, engineer of electrical construction. Mr. Bosch was with the Exposition from the time of the inception of the electrical and mechanical department until the present, a period of over two years. He was the author of an article regarding the electric conduit system of the Exposition published in this journal of July 7, 1913, and was responsible for many details of design which are now materialized in the finished construction.

MEETING NOTICES.

Los Angeles Section of the Electric Vehicle Association of America.

The first regular meeting of the season will take place on Wednesday evening, October 7, at the Jonathan Club, Los Angeles. After dinner the social and business conditions will be discussed and several papers be presented.

Southern California Section of the A. I. E. E.

Chairman **Deacon Pyle** makes the announcement that the first meeting of the season will be in the form of an excursion to the recently completed Kern River plant of the Pacific Light & Power Company, on Saturday, October 10. Special trains will convey the members to the plant, which will be described by Mr. Woodbury and his assistants.

Oregon Society Engineers Luncheon.

The first weekly luncheon of the Oregon Society of Engineers was held in the Crystal dining room of the Benson

hotel at 12:10 p. m., September 28th, with an attendance of 80 members and their invited guests. Mr. W. B. D. Dodson, trade commissioner of the Portland Commercial Club was the speaker of the day. He made a strong plea for engineering assistance in foreign trade expansion.

It is intended to make this a permanent affair and the speaker for the next luncheon is Mr. W. D. Wheelwright, president Pacific Export Lumber Company, who has recently returned from Europe and he will speak on the war situation. All members of other technical societies are invited to meet with the Oregon Society of Engineers at these luncheons.

Utah Electric Club.

The Utah Electric Club resumed their regular weekly luncheons at the Commercial Club, Salt Lake City on Thursday, October 1st. Captain W. G. Webb of the Utah Battery talked on the subject "Modern Artillery Practice," illustrating his talk with samples of the various kinds of shells used in the artillery branch of the service. Stanley S. Stevens, presided as chairman for the month of October. During the winter season the Utah Electric Club will hold luncheons every Thursday at 12:30 at the Commercial Club and all visiting members of the electrical fraternity are cordially invited to attend. W. W. Torrence, local manager of the General Electric Company is president and Bayard W. Mendenhall, commercial agent of the Utah Light & Traction Company is secretary.

Electrical Development and Jovian League.

September 6th was Jovian Day at the League. The speaker of the day was Mr. Robert L. Eltringham, safety engineer of the Industrial Accident Commission of California, who told most interestingly of the work being carried on by the Commission and stated the world was commencing to realize that the people who are producing the wealth of the world are entitled to some form of recognition for their services and are entitled to all possible protection. It is in furtherance of this object that the "Safety First" slogan and movement come into existence.

The speaker was followed by Mr. Brownell, "Superintendent of Safety" of the Commission, who also gave some interesting figures and experiences. The meeting, presided over by President Heise, who also tendered some remarks on the subject, closed by a vote of thanks to the speakers.

Joint Pole Commission, Portland, Oregon.

H. R. Wakeman, superintendent of lines and conduits of the Portland Railway, Light & Power Company has been elected president of the Joint Pole Commission. A joint pole agreement has been formally signed by the Portland Railway, Light & Power Company, the Northwestern Electric Company, the Pacific Telephone & Telegraph Company, and the Home Telephone Company. No secretary has been as yet appointed. The expenses are to be borne jointly.

In July of 1913, Mr. F. D. Weber, electrical inspector of the Underwriters' Equitable Rating Bureau, suggested to the Oregon Society of Engineers the necessity of creating a joint pole commission for the city of Portland. This suggestion was acted upon by the society and Mr. Weber was appointed chairman of a committee to get this matter considered by the utilities interested.

After several meetings of the committee, the city of Portland passed an ordinance, No. 27,786, "Empowering the Commissioner of Public Utilities to devise plans for the elimination of poles and overhead wires from the streets."

At a public hearing held at the city hall, on this ordinance, after its passage, a new committee was formed with wider scope and Mr. O. B. Coldwell, superintendent of power and light, was appointed chairman. This new committee finished its labors in January, 1914, and now the companies have formally accepted this agreement.

Jovian Electrical League of Southern California.

The weekly luncheon of the league, held at Christopher's, Los Angeles, on Wednesday, September 30, presided over by F. Menominee Sinsabaugh, was attended by about 120 Jovians.

and a number of guests, who cheered enthusiastically when it was announced that Statesman Colkitt had recently become the father of a little Miss Colkitt. As a token of his appreciation, Papa Colkitt passed the cigars around in person. Stentor Pieper had provided a splendid musical program, which was followed by a very interesting talk by Dr. C. L. Edwards, on the remarkable journey into the Klamath forest by Joe Knowles. As Dr. Edwards accompanied Mr. Knowles as the accredited representative of a newspaper, and had carefully recorded his activities and experiences, the story was listened to with intense interest. He described Mr. Knowles as a most accomplished nature student and artist, whose powers of endurance were due largely to Indian blood which ran through his veins. Knowles entered the forest without tools, clothing and food, and the speaker explained how the man, in primitive fashion, procured his food, his clothing and his fire, illustrating the latter by the use of the actual implements. He showed how ground squirrel and trout were caught, how dandelion and hearts of fern were made into salads and how, without paints and brushes, a beautiful picture was produced by this "primitive" man alone in the vastness of the mountains. The speaker exhibited this picture made on birch bark, as well as the poetic messages left behind for those who acted as witnesses of this interesting and novel expedition.

THIRTY-FIFTH ANNIVERSARY OF ELECTRIC LIGHTING.

Wednesday, October 21, this year, will commemorate the thirty-fifth anniversary of the invention of the electric incandescent lamp by Thomas A. Edison. This day in 1879 may be said, broadly speaking, to mark the birth of electric lighting. Certainly it marked the birth of the general and popular use of electric lamps. Arc lamps had been in use some years previous to this time, but only a few of these were then employed for searchlights, to light theaters, parks, street corners and similar public places. The universal lighting of both public buildings of all kinds as well as private dwellings by electricity through small units became a dream realized only when Edison first successfully made his electric filament bulb glow in his laboratory at Menlo Park, N. J., thirty-five years ago.

So great have been the benefits to mankind from the general employment of electric illumination that Edison may well be acclaimed not only one of the world's most wonderful inventors, but also one of her greatest humanitarians. It is therefore an entirely fitting tribute to the genius of the man that the twenty-first of October this year should be celebrated both by the industrial world and the general public as a national anniversary. It is particularly appropriate that this day, which will be known as "Edison Day," should be observed at this time in this country as a signal example of the triumph or peaceful constructive achievement in contrast with the present colossal destructive movements against civilization and her pursuits in the Old World.

Many local campaigns of lighting companies that has already been started will culminate on Edison Day. Some companies intend to show their appreciation of Edison's achievements by various novel features, such as stopping the street cars for half a minute at high noon on October 21st, and by offering special inducements to non-users of electric service to begin its use at that time. Strong effort will be made to present the desirability of replacing inefficient carbon lamps with the modern efficient Edison Mazda lamps. The campaign will afford lighting companies the opportunity to combine all their separate campaigns, such as house-wiring, sign-lighting, high efficiency lamps, etc., into one great effort. The thousand-watt high efficiency gas-filled Mazda lamp will be exhibited by many as an example of the tremendous progress that has been made in electric lighting in the last thirty-five years. This lamp now gives relatively twelve times as much candlepower per watt as Edison's earlier lamps.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision authorizing the Union Home Telephone & Telegraph Company to issue \$22,700 of promissory notes to be used in refunding other notes outstanding.

The commission has issued an order to the Lindsay Home Telephone & Telegraph Company, granting it an extension of time to March 31, 1915, in which to issue a note or notes in the sum of \$2000.

The commission has rendered a decision authorizing the Pacific Light & Power Corporation to issue \$170,000 face value of its first and refunding bonds to be used in complying with the sinking fund provisions of its trust deed.

The commission has rendered a decision granting the Sausalito Incline Railway Company a certificate of public convenience and necessity to operate an incline railway in the town of Sausalito, Marin county. The company is also authorized to issue \$15,000 preferred or common stock for the acquisition of right of way and other real property; \$2500 of preferred stock to Dr. Allen H. Vance for promotion services and \$500 of preferred or common stock to complete final plans for the construction of the road.

The commission has rendered a decision authorizing the Pacific Light & Power Corporation to issue 19,430 shares of its first preferred 6 per cent cumulative stock at not less than \$85 per share, and \$4,382,000 of first and refunding mortgage bonds at not less than 85 and accrued interest, with the provision that the bond issue shall be made subsequent to the stock issue. It is further provided that the company shall only issue the bonds when it shall have complied with the provisions of the deed of trust to the United States Mortgage & Trust Company.

The commission has rendered a decision authorizing the Consolidated Securities Company to sell its telephone system in the City of San Fernando, Los Angeles county, to the San Fernando Telephone & Telegraph Company. In return, the telephone company was authorized to issue a promissory note in the sum of \$20,000 bearing interest at 6 per cent per annum—the principal payable in installments over a period of 20 years. The telephone company is also authorized to issue \$10,000 par value of its capital stock to be sold for not less than par and to be used for additions and betterments to its system. The authorization of the transfer of property will not become effective until the aforementioned \$10,000 of stock has been sold.

NEWS OF WASHINGTON PUBLIC SERVICE COMMISSION.

The commission has issued orders permitting the Puget Sound Traction, Light & Power Company to furnish free light—the service to the state fish exhibit, to issue L. S. N. rates for lights for theatres, and public markets in Seattle, as well as vacation rates for schools.

The case of H. J. Palmer vs. Northwestern Electric & Water Company, was dismissed, as it had been settled by stipulation.

The rate complaint of the City of Spokane against the Washington Water Power Company was dismissed upon petition of complainant.

The rates of the Cowiche Telephone Company have been found to be reasonable. In the valuation of this company the following decision has been reached: Cost of reproduction, new, \$11,708; less depreciation, \$70,005; operating expenses, \$2838; revenue, \$2923. Fair value found, \$9300.

The following dates have been set for hearing:

October 9, 9:30 A. M.—Seattle, Commission ex rel. B. Weiman vs. Richmond Beach Telephone & Power Company. Service.

October 14, 9:30 A. M.—Port Townsend, Commission rel. City of Port Townsend vs. Key City Light & Power Company. Rates, etc.

October 20, 9:30 A. M.—Everett, Commission ex rel. Geo. T. Hendrie et al. vs. Everett Gas Company. Rates.

October 29, 9:30 A. M.—Seattle. Rules re telephone collections.

October 7, 9:30 A. M.—Seattle, Watts vs. Independent Telephone Company. Service.

November 30, 9:30 A. M.—Seattle. Seattle vs. Seattle Lighting Company. Valuation, rates.

NEWS OF ARIZONA RAILROAD COMMISSION.

The Southern Pacific Company has been granted until October 26, 1914, to show cause why it should not be punished for contempt of the commission's order regarding locomotive headlights.

The Winslow Gas Company has been authorized to issue first mortgage 7 per cent gold bonds in the amount of \$60,000, to be used in the erection of a gas plant and distribution system at Winslow.

The Arizona Hydraulic Power Company has been authorized to purchase the power site and water rights of the Pacific Water Power Company and E. H. Meek on the Verde River to be paid for by 100,000 shares of stock. A \$2,000,000 bond issue has also been authorized to be used in the construction of dams, storage works, power plants, transmission lines, etc.

The Salt River Electric Railway Company has been granted a certificate of convenience and necessity for the purpose of constructing, operating and maintaining an electric street railway system in the city of Phoenix.

TRADE NOTES.

NePage, McKenny & Company, electrical engineers and contractors with offices in all of the chief Pacific Coast cities, announce from their Seattle offices that they have secured the contract for complete electrical installations in the eleven-story Stuart building now under construction in Seattle, the contract approximating \$12,000. They have also secured the contract for the electrical work complete in the Oakland auditorium at Oakland, California, amounting to \$35,000. This job calls for seven switchboards.

Colby Engineering Company of Portland has recently installed a 500 kw. Curtis turbo generator, with Lyons boiler equipped with Dutch oven and auxiliary oil burners for the Tillamook Light & Power Company at Tillamook, Ore.

The W. H. Smith Electric Engineering Company of Portland, Oregon, has obtained the electrical contract for the new postoffice being built at Idaho Falls, Idaho. This company also has the electric fixture contract for the Iris apartments at Portland.

The Grand Electric Company of Portland, Oregon has the electrical contract for the new apartment house being built at East Twenty-fourth and Sandy Road, Portland.

The J. C. English Company, fixture manufacturers of Portland, has obtained the contract for the fixtures in the new apartment house located at the southwest corner of Yamhill and Lownsdale streets, and also for the B'nai B'rith Association Building on Thirteenth, near Mill street, Portland.

NePage, McKinney Company have the electrical contract for the building owned by the Labbe estate on Union avenue and Ash streets, Portland, Oregon; also the addition work being installed in the city jail at Second and Oak streets.

M. J. Walsh & Company of Portland, have the electrical contract for the A. O. H. lodge building being erected at Russell and Rodney avenues.

The Truitt Electric Company, Los Angeles, was recently incorporated by Fred L. Somers, Elliott Hinman, Clarence Truitt, George L. Belcher and Thomas Harrison. The capital stock of the company, which will manufacture electric ovens, is \$25,000.

The Los Angeles Gas & Electric Company has recently obtained contracts from the city of Los Angeles for the installation of about 500 General Electric magnetite arc lamps.



INDUSTRIAL



CONTRACTORS' SAMPLE ROOM.

The California Association of Electrical Contractors and Dealers are maintaining a sample room of electrical wiring devices at their headquarters in the Rialto Building, San Francisco. This is an educative exhibit for architects, their

with a plate shelf. Space is rented to various manufacturers, who install their exhibit samples, which are hung loosely so that they may be examined.

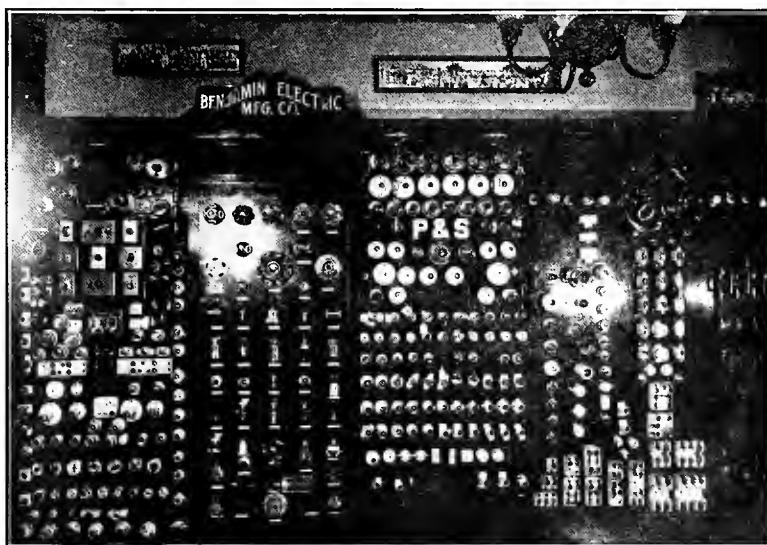
The sample room is also used for the office of the secretary and a reading room for the members. Many



Section of Contractors' Display Room.



Section of Panel Display.



Section of Exhibit.

clients and the contractors. This exhibit has been established in accordance with a suggestion made by John Austin, a prominent architect of Los Angeles.

As may be noted from the accompanying illustrations the rooms have been paneled to a height of 7 ft. 2 in. and finished

architects have visited the place and are greatly pleased with the plan. Many contractors also employ the service to find material which they are unable to locate in catalogues.

The following goods are on exhibition:

- | | |
|--|--|
| Annunciators.
"Edwards." | Conduit (Flexible Steel).
Sprague, National Metal Moulding. |
| Attachment Plugs.
Bryant, Benjamin, General Electric, Hubbell, Cutler-Hammer. | Conduit (Non-Metallic).
National Metal Moulding. |
| Base Receptacles.
Bryant, General Electric, Cutler-Hammer, Arrow E., Hart & Hagerman, Trumbull, Hubbell. | Conduit (Rigid).
Sprague, Economy, Sheraduct. |
| Batteries.
Thos. Edison Inc. National Carbon Co. | Condulets.
Crouse-Hinds. |
| Bells.
"Edwards." | Cutouts.
Union, Bryant, General Electric, D. & W., Trumbull. |
| Clusters.
Benjamin. | Fuses.
General Electric, Union, D. & W. |
| | Letter Boxes.
Western Electric Company. |

Metal Moulding and Fittings.
National Metal Moulding.

Outlet Boxes.
National Metal Moulding,
Union, Sprague.

Receptacles.
Bryant, Benjamin, Pass &
Seymour, Cutler-Hammer,
Hubbell, Arrow E.

Rosettes.
Bryant, Arrow E, Pass &
Seymour, General Electric.

Sockets.
Bryant, Benjamin, Pass &
Seymour, General Electric.
Cutler-Hammer, Arrow E,
Hubbell.

Soldering Pastes.
Allen.

Switches (Knife).
Trumbull, Bryant, General

Electric, A. G. Elec. & Mfg.
Drendell Elec.

Switches. (Snap, Flush, Auto-
mobile).
Hart & Hagerman, Arrow E,
Cutler-Hammer, General
Electric, Bryant, Perkins.

**Switch Boards—Panel Boards
and Boxes.**
A. G. Elec. & Mfg. Co., Dren-
dell Elec. & Mfg. Co., Trum-
bull.

Telephone Cable.
Western Electric Co.

Telephones.
Western Electric Company.

Wire.
Standard Underground Ca-
ble Co., General Electric
Co., Sprague Electric Co.

THE MAZDA BEES.

The Mazda bureau of the General Electric Company, of which H. H. Cudmore is director, has an organization of specialists to which the success of the preliminary work of the recently established bureau is largely due. Because of the



Clark Baker.

F. J. Blaschke.

A. B. Bond.

coincidence of cognominal initials of Mr. Cudmore's associates, who busily boost the trademark suggested in the name of the organization, they have been termed the Mazda Bees.

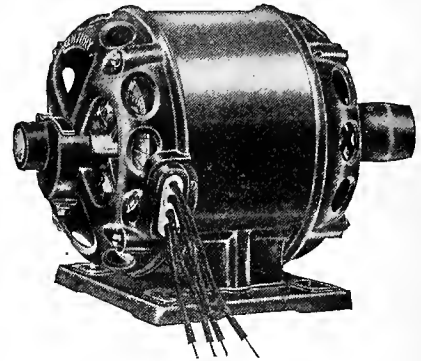
Messrs. Baker and Bond are field representatives and Mr. Blaschke is in charge of publicity and exhibits.

The Mazda bureau staff has been identified with the incandescent lamp industry in various capacities for a number of years. Mr. Baker was in charge of the Cleveland, Ohio, district office of the Westinghouse Lamp Company previous to his present association. Mr. Bond was formerly connected with the home office of the Edison Lamp Works of the General Electric Company in an executive capacity at Harrison, N. J., and Mr. Blaschke joined the bureau after having been engaged in engineering publicity with the National Lamp Works of General Electric Company, Cleveland, Ohio, for several years.

The Mazda bureau is engaged in the exploitation of the Mazda trademark in the Pacific Coast district through intensive, localized, educational publicity campaigns. Distributors and consumers of lamps bearing the Mazda mark, irrespective of brand, are given the services of the bureau and the personal co-operation of its members in the effort to acquaint the current-using public with the meaning of Mazda.

NEW CENTURY MOTOR.

The demand among central station operators for small alternating current motors capable of starting under full load with a low starting current, especially capable of starting on the small fuses usually found in residence districts, and



1/6 h.p. Century Motor.

the demand among the machinery manufacturers for a motor capable of developing a high starting torque, has led the Century Electric Company to develop a 1-6 h.p. motor as an addition to their present complete line of "Century" single-phase motors, which are of the repulsion starting, induction running type.

The same general design and construction prevails in this motor that is characteristic of the remainder of the "Century" line. It is capable of developing a starting torque more than two and one-half times full load torque with a starting current of less than three times full load current, and capable of developing a maximum, when it is up to speed, of approximately 200 per cent of full load torque. It is equipped with phosphor bronze ring oiling bearings which makes it especially valuable for the operation of apparatus in places where the motor is subjected to low winter temperatures. The standard winding is 104-208 volts interchangeable which enables the manufacturer to equip his apparatus with motors and put the complete equipment in stock with reasonable assurance that the motor can be used on either of the prevailing voltages usually found in this country.

This motor has been on the market but a few weeks. There is already a promising demand for it, since it is able to start practically any apparatus which small motors are called upon to drive with the use of only a 3 ampere fuse.

NEW CATALOGUES.

Westinghouse Electric & Manufacturing Company are distributing pamphlets illustrating and describing electric Glue Pots and Glue Cookers and Electric Drive for Flour Mills. Descriptive Leaflet 3693 illustrates and describes Electric Drive for Rubber Calendars, and No. 3742 is devoted to Westinghouse Motor Generator Sets.

A number of interesting bulletins have recently been issued by the Sprague Electric Works of General Electric Company. No. 48,701 is devoted to Sprague Electric Dynamos for measuring horsepower. Full directions and illustrations are given of approved methods for engineering tests. No. 48,700 illustrates and describes Sprague Monorail Cranes, a device for reducing costs and increasing efficiency in industrial plants. Electric hoists for the efficient handling of all loads, are also illustrated in Booklet 906.



NEWS NOTES



INCORPORATIONS.

POMONA, CAL.—Truitt Electric Company, \$25,000, subscribed \$50, by F. L. Somers, E. Hinman, C. Truitt et al.

LOS ANGELES, CAL.—Western Imperial Electric Company \$200,000, subscribed \$500, by G. A. Plutenney, G. W. Grayson, H. C. Jackson, E. E. Whitney Jr. and F. C. Sutphen.

SEATTLE, WASH.—The Summit Lake Power Company has been incorporated with a capitalization of \$4,000,000 by Jos. K. Dorr and F. P. Mullen, care Fletcher & Evans, Tacoma.

GARDEN GROVE, CAL.—A number of water companies and other interested parties have united and incorporated the Garden Grove City Water Company with a capitalization of \$25,000. The company will erect a large storage tank, install a new pumping plant and construct new distribution lines. The newly elected board of directors is composed of J. D. Price, P. H. German, H. A. Lake, J. T. McElree and J. A. Knapp. J. A. Knapp is president.

FINANCIAL.

SEATTLE, WASH.—An ordinance will be introduced in the council to sell \$404,000 light bonds in denominations of \$100 and \$500 so that citizens may purchase them.

SPOKANE, WASH.—A mortgage covering real and personal property and water rights of the Little Spokane Light & Power Company of Deer Park, has been given to the Spokane & Eastern Trust Company to secure a bond issue of \$15,000. The power company plans to extend its service to other towns.

TULARE, CAL.—Active work started this week by the officials of the Tulare County Power Company on the sale of an issue of \$400,000 in bonds to the power users who are stockholders of the corporation. As far as is known here the Tulare County Company is the only co-operative electrical power concern in the United States. In a recent statement which was issued by the corporation it was set forth that the physical property of the company, which includes 400 miles of transmission lines, is worth \$800,000, against which there is an indebtedness of \$300,000. The present bond issue will be used to pay off all indebtedness of whatever description and the \$100,000 balance will be put in a fund for betterments and extensions of the lines.

SAN FRANCISCO, CAL.—Hearings before Judge Dooling in the matter of the receivership for the Northern Electric Company asked by the General Railway Signal Company, brought out the fact that unsecured claims amounting to \$1,100,000 exist in addition to the interest on the company's bond issues, in default since June 1, 1914. Among the liabilities mentioned is approximately \$4,000,000 in promissory notes secured by bonds on which the annual interest is \$260,000. There is a further liability of \$500,000 on which the interest amounts to \$30,000. The open-book accounts are placed at \$600,000, bearing an annual interest charge of \$42,000. Certain costs must be met and improvements made, the immediate sum necessary for these purposes being placed at \$200,000. The petition says that it will be many years before the company will earn all these charges, and that, unless some relief is furnished by the court, the property will be sold piecemeal under judgments obtained in various courts, its value greatly depreciated and the rights of secured creditors imperiled. Most of the \$4,000,000 promissory notes described in the petition are indorsed by E. R. Lilienthal, E. J. de Sabla Jr., Louis Sloss and W. P. Hammon, as are the \$191,000 funded notes.

ILLUMINATION.

LOS ANGELES, CAL.—At a recent election held at Hawthorne, it was voted to install 84 new street lights. The newly lighted district will include the section known as the Burleigh tract.

LONG BEACH, CAL.—The board of public works has granted a 30 day extension of time to the Woodhill & Hulse Electric Company on the installation of an ornamental lighting system on Broadway.

SPOKANE, WASH.—Promoters of the lighting project on Sprague street are endeavoring to get plans completed in order that the contract may be let at the same time as the First avenue lighting contract.

POMONA, CAL.—A special committee composed of F. E. Whitehouse, Wade Carper, A. T. Richardson, W. M. Doud and W. C. Blackmore has been appointed to further interests of ornamental lighting proposition for Pomona.

SEATTLE, WASH.—A resolution has been passed providing for the installation of a system of cluster lights on Madison street, according to plans prepared by the city engineer. Objections will be heard on October 19th.

AZUSA, CAL.—Preparations are being made to call a \$55,000 bond election, the proceeds of which will be used for a water system costing \$35,000, and lighting plant, costing \$20,000. The lighting system will include lights along Foothill boulevard, Azusa avenue and Center street.

EL PASO, TEX.—Work is under way by the El Paso Gas Company on improvements, including the entire rebuilding of part of the plant, and laying of additional mains, to cost \$68,000. At the plant proper a new coal gas plant is to be built. The steel work contract has been let to the El Paso Bridge & Iron Company.

SEATTLE, WASH.—The lighting department allowance for October includes \$40,000 for the purchase of cables for an underground system so that materials can be assembled and work begin on removal of poles on Yesler Way and the waterfront districts. Also an additional boiler will be purchased for the steam power plant on Lake Union.

PORTLAND, ORE.—Property owners and business men on Fourth street from Yamhill to Burnside streets have been granted permission by the city commission to install a system of street bracket lights. As soon as plans can be made work will begin. The cost and the lighting bill will be paid by the property owners. President McFaul has appointed John Daniels, D. H. Strowbridge, Robert Andrews, Fred J. Brady and N. N. Carpenter a committee from the East Side Business Men's Club to interview property owners on Grand avenue with a view to having that street illuminated.

BAKER, ORE.—The Eastern Oregon Light & Power Company has filed a notice of appeal in the suit brought against it by the town of Haines, which was decided in favor of the plaintiff by Judge Anderson, August 4. The principal point of divergence between the town and the company is in regard to the construction of the part of the franchise providing for a flat rate for electricity. That the flat rate was not observed is admitted, but the company claims that the franchise properly construed would permit such departures as took place. Judge Anderson held otherwise and ordered the establishment of a flat rate instead of meters.

SALT LAKE CITY, UTAH.—At a meeting of the Salt Lake Federation of Labor on September 30th the annual Utah State Fair was declared to be unfair, this condition resulting from the strike recently declared by the local inside wiremen. The local contractor who had the work of installing festoons, wiring and special lighting about the Fair grounds employed non-union wiremen to complete this job

so that the union linemen of the Utah Light & Traction Company who were engaged in installing the transformers and making the service connection to the grounds were ordered off the job by the State Federation of Labor. The lighting company promptly made other arrangements for the installation of the transformers and the grounds were connected up, the meeting of the Federation on the 30th declaring the entire State Fair unfair was the outcome. The linemen of the Utah Light & Traction Company are on strike so that the work of making service connections and disconnections is temporarily held up.

TRANSMISSION.

SUMMERVILLE, ORE.—The Klees Electric Company is extending its light and water systems into the Grande Ronde Valley.

CHEHALIS, WASH.—A franchise has been granted to the Independent Electric Company for a high tension power line from Winlock to Toledo, by the county commissioners.

HELENA, MONT.—The Montana Power Company has started the preliminary work of extending its power lines from Thompson Falls to the Coeur d'Alene mining district.

WINLOCK, WASH.—The Independent Electric Company, a subsidiary of the Washington-Oregon Corporation, has applied for a franchise to construct and maintain a power line over the county road from Winlock to Toledo, Washington.

PRESCOTT, ARIZ.—The Arizona Power Company has closed another contract for power to be furnished the Clarkdale smelter of the United Verde Copper Company, which will require the generation of additional 2000 h.p. The service is to be ready by November 1.

DUNCAN, ARIZ.—A power plant is to be begun soon in Greenlee county, surveyors having been sent from San Francisco to make surveys for a power project on Black River, at the mouth of Pachete Creek. Backers of the project are F. G. Baum and associates of San Francisco and John Christy of Clifton, a large dam will be built across the Pachete and a hydroelectric plant will be installed.

FRESNO, CAL.—A new electric service line is being built from Santa Maria to Lompoc by the Midland Counties Public Service Corporation, according to announcement made by A. G. Wishon, general manager of the corporation. The new line will cost about \$15,000 when completed. The current will be released to the Lompoc Light & Power Company for general distribution, but the chief object of the extension is to furnish electricity to the Kiselguhr Company for mining and manufacturing work, according to Wishon.

SEATTLE, WASH.—Three measures have been introduced in the city council looking toward the acquisition of the Lake Cushman power site. Two of the measures introduced in the city council looking toward the acquisition of an application for rights on all the state and federal lands in the district, which it is proposed to flood. The third is an ordinance directing a thorough examination of the proposed site of the plant by experts and appropriating sufficient money for a similar examination of such other sites as may merit consideration.

TRANSPORTATION.

EUGENE, ORE.—An electric railroad, three miles in length, to operate between Glendale, on the Siuslaw River, and Tsiltcoos Lake, south of the Siuslaw, is contemplated by Siuslaw capital.

SAN FRANCISCO, CAL.—Mayor Rolph's attention has been called to the need of strips or guards on the sides of street cars to keep persons from falling under the wheels, and he has referred the matter to the public utilities committee of the supervisors.

OAKLAND, CAL.—The Key Route service in Twelfth street from Poplar street junction to Broadway, in Oakland, that has been in operation for the past five months has ceased, under directions issued by Mayor Mott. The San Francisco-

Oakland Terminal Railways had asked permission of the city council to continue indefinitely that service.

BERKELEY, CAL.—Judge M. T. Dooling of the U. S. District Court issued an injunction preventing the city officials of Berkeley from stopping the Key Route traffic on Shattuck avenue. The street paving fight thus becomes a legal battle with the trains still running. The threatened tie-up was designed to force the Key Route system to pave between its tracks on Grove and Adeline streets.

TURLOCK, CAL.—F. P. Will, superintendent of the Burlingame Railway, proposes to establish a trackless trolley between Turlock and Denair, a distance of four miles, the object being to make connection between the Santa Fe trains, which pass through Denair, and the Southern Pacific trains, which pass through this city. About \$20,000 will be required to build the line.

FAIRFIELD, CAL.—The city trustees of Benicia have been asked for a franchise for an electric railroad through the city streets to the city limits on the Vallejo road. The application was made by A. D. Bowen, president of the Benicia Land & Terminal Company, who proposes to build a road from Benicia to Vallejo and a line from Benicia to Winters. Officials of the company state that the Benicia-Vallejo line will be in operation within one year.

TELEPHONE AND TELEGRAPH.

RIVERSIDE, CAL.—The bid of Floyd Brown for a telephone franchise in Palo Verde valley, has been accepted by the board of supervisors.

SAN FRANCISCO, CAL.—Proposals have been taken by the buildings and grounds committee of the Panama-Pacific International Exposition Company for constructing a telephone exchange in the Food Products Building.

CHEHALIS, WASH.—The Farmers' Independent Telephone Association has been granted a franchise to operate over the county roads between Chehalis and Mossy Rock, Washington, the franchise covering a period of twenty years.

SAN FRANCISCO, CAL.—The board of works has awarded two contracts for equipping the new central fire-alarm station in Jefferson Square; that for the underground conduit going to James H. O'Brien for \$3115 and that for marble switchboards and appurtenances to the Butte Engineering & Electric Company for \$7321.

WATERWORKS.

RED BLUFF, CAL.—A petition calling for an election to bond the city in the sum of \$85,000 to establish a municipal water system is being circulated.

ST. MARIES, IDAHO.—The city clerk has been instructed to engage a hydraulic engineer to examine the water supply, also to ascertain the cost of installing an adequate water system.

SPOKANE, WASH.—Commissioner C. M. Fassett has issued petitions for laying water mains in several additions in the northwestern portion of the city. The mains if laid will be paid for on the assessment plan.

SEATTLE, WASH.—L. B. Young, superintendent of the water department, will begin work shortly on the construction of two large steel water mains within the city limits that will cost between \$75,000 and \$100,000.

SAN DIEGO, CAL.—Mayor O'Neal has announced that when the Vulcan water proposition is voted on there will also be included on the ballot a \$500,000 proposition for the development of San Diego River. This proposition was suggested by the Mayor and endorsed by Councilman Wm. G. Henshaw.

GRANTS PASS, ORE.—A proposal from the Rogné River Water Company involving the purchase by the city of the water system has been presented to the council by Mayor McKinstry. The company had set a price of \$125,000 upon the system, agreeing to take as payment city bonds at 5½ per cent interest.

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KEY CITY LIGHT AND POWER COMPANY.
A RESUME AND COMPARISON OF RATE THEORIES.
BY STACY HAMILTON.

STANDARDS AT SAN DIEGO.
BY L. M. KLAUBER.

ELECTRIC HEADLIGHTS.
BY A. G. JONES.

PATENTS A PROFITABLE FIELD.
BY GEORGE J. HENRY.

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KEY CITY LIGHT AND POWER COMPANY

Coincident with the development of the great electric transmission networks of the West has been the gradual introduction of gas and electric service into smaller and more isolated communities, by independent companies. Typical of this class of company is the Key City Light & Power Company which serves the power and lighting needs of the thriving town of Port Townsend on Puget Sound, Washington, across the Strait of Juan de Fuca from Victoria, B. C.

At the Key City substation this power is stepped down to 2300 volts for local distribution by means of three 125 kw. oil cooled General Electric transformers. The switching equipment at this substation includes three 200 ampere, 66,000 volt automatic oil switches, one 66,000 volt Pacific Electric pole top switch with fuse, together with the usual lightning arrester and choke coil equipment, as well as proper switchboard apparatus.



Port Townsend, Washington.

The city of Port Townsend has an area of about nine square miles at the northeasterly end of the Olympic peninsula. Of this area about three square miles is served with electric current, the main supply being transmitted from the hydroelectric plant of the Olympic Power Company, the Key City Light & Power Company also having an auxiliary steam plant at Port Townsend. This company likewise furnishes gas to the town, which has a population of about 4000.

The Olympic Power Company operates two 6000 k.v.a. Westinghouse generators driven by 9600 h.p. turbines at a hydroelectric plant in Elwha Canyon, seven miles from Port Angeles, Washington. This power is transmitted at 66,000 volts over a hundred miles of line to various consumers, including the municipal plant at Port Angeles, the navy yard at Bremerton, the Key City company at Port Townsend, and Hood's Canal.

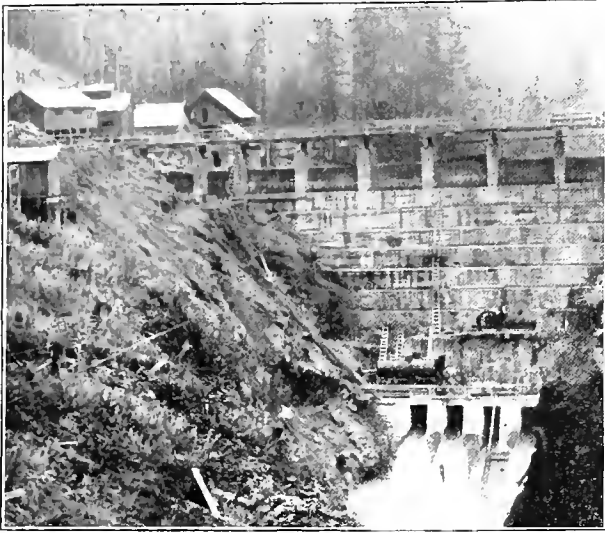
The auxiliary steam plant, which was the chief source of supply before the hydroelectric plant was completed, has two 2300 volt a.c. generators, one a 90 kw. Stanley and the other a 50 kw. General Electric machine driven by reciprocating engines. Steam is furnished at 150 lb. pressure by a Geary and an Atlas water tube boiler equipped for oil or wood firing, having a total rating of 325 h.p. The 80 kw. machine is direct connected to a McEwen compound engine, and the 50 kw. generator is belt driven from a 9 by 12 in. Ball engine.

Electric distribution is at 220 volts a.c., there being 15.75 miles of pole line. Lighting service is supplied at 115 volts and motor service at 220 volts. The average length of pole line per customer served is 175.7 ft.; 231.5 ft. being the average per residence consumer. A part of the town is served by 45 ft. poles used jointly with the Citizens' Independent Telephone

Company. The upper 7 ft. are used by the power company.

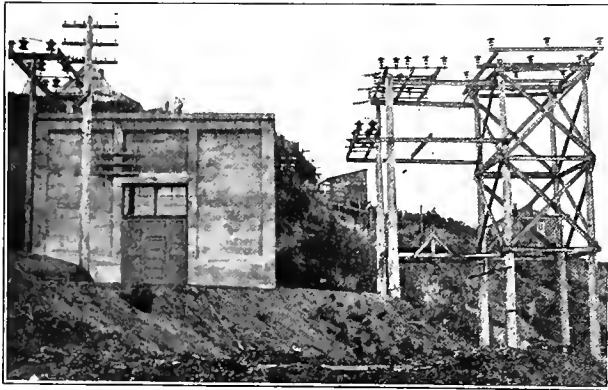
An interesting feature in connection with distribution line practice is the use of a portable derrick for

ulators. Another .69 mile section cost \$378.50 per mile, the ground being loose gravel and sand. The derrick is equipped with detachable wheels on which it is hauled from place to place by hitching to a wagon.

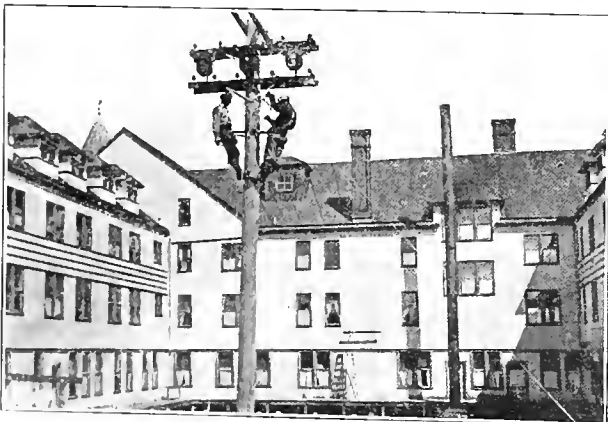


12,000 k.v.a. Hydroelectric Plant of Olympic Power Company.

raising and resetting poles. By this rig it is possible for two men to quickly handle 40 and 45 ft. poles at a minimum expense. One section of line 1.25 miles in

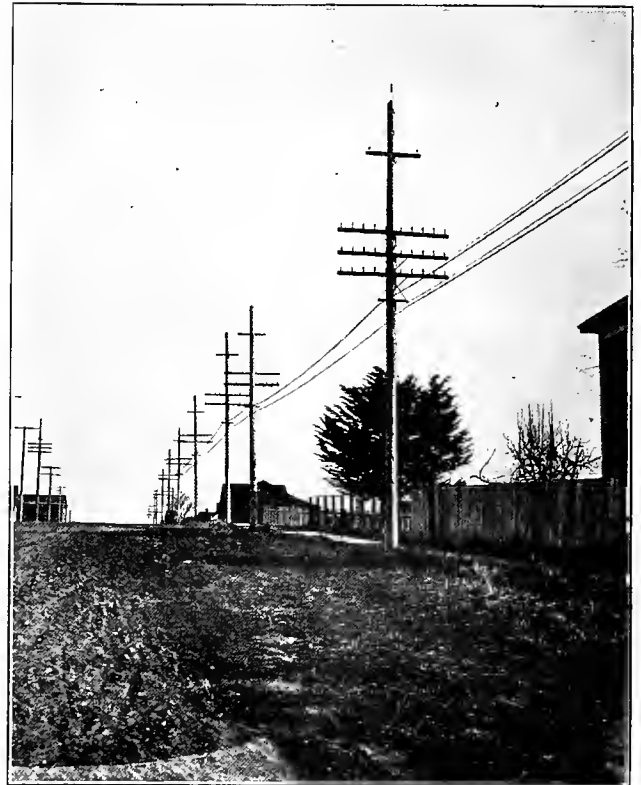


425 k.v.a. Substation of Key City Light and Power Company.



Pole Equipment Serving Cliff Lodge Hotel.

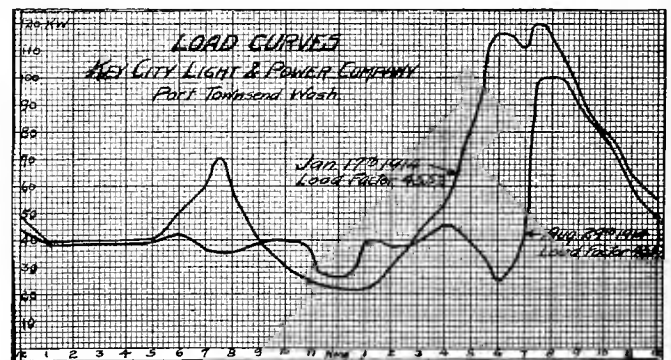
length was constructed at a cost of \$436.60 per mile; including the stringing of wires. The poles were 35 ft. in length, 50 in number, and spaced 130 ft. The ground was hard pan. The cross arms were 3 by 4½ by 8 ft., equipped with Pierce pins and Thomas in-



Joint Power and Telephone Pole Line.

There are 13½ miles of street lighting circuit, most of the lighting being by means of series 80 c.p. nitrogen filled Mazda lamps, mounted on brackets and fitted with reflectors. There are also seven 6.6 ampere flaming arc lamps, all-night lighting service being provided.

The company is serving 485 electric consumers, there being 13 motors of 1 h.p. or more having an aggregate load of 58 h.p. More than three-fourths of the residence consumers have electric irons and other appliances, as is well indicated by the load curve in-



Load Curve Showing Off-Peak Business Secured in 3½ Years.

crease during the past 3½ years. The rates scale down from 10 cents per kw.-hr., with \$1 monthly minimum. Receipts of \$7.93 per capita were obtained during 1913. For most of the information presented the writer is indebted to J. M. Kincaid, secretary and general manager of the company.

A RESUME AND COMPARISON OF RATE THEORIES,

BY STACY HAMILTON.

(This paper discusses some of the good and bad features of various rate theories and schedules, particularly as interpreted in the light of Commission decisions. It was presented at the Spokane meeting of the N. W. Electric Light & Power Association. The author is connected with the Portland Railway, Light & Power Company.—The Editor.)

This paper has been confined to electric light and power rates as being of most interest to this meeting. The writer is not undertaking to introduce any new theories as a general panacea for the innumerable



Key City Light & Power Company's Gas Works.

rate problems, but rather to discuss some of the good and bad features of the various rate theories and rate schedule forms now in use and to give some references to Court and Commission decisions having direct bearing on the points discussed.

The general subject of rates may well be divided into two general divisions, the first being devoted to a discussion of the revenue which a utility is entitled to derive from its investment and activities, and the second division dealing with the various methods in which the predetermined revenue may be obtained from the different classes of service rendered.

The determination of the permissible revenue involves, of course, the problem of fixing upon a fair valuation of the property both tangible and intangible, and a fair rate of return on the investment.

It is, however, with the second division only of the rate subject that this paper is to deal. The problems here presented are those arising after the valuation and a fair return on the investment have been determined.

Let us assume, for example, that a property devoted exclusively to the manufacture and distribution of electric light, power and heat, has been valued at \$1,000,000, after due consideration of all the factors which enter into the proper determination of the value as a basis for the rates. Let us assume that 10 per cent has been determined as a fair return on the investment over and above operating expenses, including maintenance and depreciation, which we will assume have been shown to be \$80,000 per year.

The gross revenue of this company should then be \$100,000 per annum to cover interest charges and profit, plus \$80,000 per annum to cover operating expenses, maintenance and depreciation, or a total gross

revenue of \$180,000. This, then, is the revenue which this company is entitled to earn (if it can) with an equipment and organization valued at \$1,000,000.

This brings us to the second division of the rate problem. The question now arises—What is the most equitable, practicable, and mutually satisfactory way in which this \$180,000 per year can be apportioned among the various sources of this company's revenue.

The apportionment of the revenue among the various classes of service is naturally influenced to a certain extent by the schedules which are offered for each class, and, in the establishment of a system of rates, it is of no small importance to select a form of



Portable Derrick for Raising and Setting Poles.

rate for each class, which, in addition to being fair and equitable, will also encourage the greatest profitable development of the business of that class. For example, simplicity in expression is an important requisite, especially in residence rates. Again, in the case of power business, some form of load factor discount is of importance in order that the charge may automatically adjust itself to properly compete with other forms of power.

Those central stations which have been through the experience of making changes in the form of their rate schedules, appreciate the importance of minimizing these changes as much as possible by a very careful consideration of the form and other details of a rate schedule before it is put into effect. Under the present day regulation and close scrutiny of public utility rates, any central station, no matter how justified it may be, will experience considerable difficulty

in making a revision which will result in an increase for even a few individuals, even though the revision, as a whole, may be a reduction in the company's revenue. Changes in the form of rates will quite often more or less increase certain individual consumers, and the objections raised by these comparatively few consumers through the newspapers and otherwise, are apt to give the impression to the average citizen of the community that the change in the rates represents a general increase rather than an exceptional increase. Under these circumstances, the central station not only receives no credit for its general reduction, but is often subjected to considerable unfavorable criticism.

The usual result, therefore, in making a change in a rate, is a material decrease in revenue, even though the management only desires to change the form. It is, therefore, of the utmost importance that careful consideration of all phases be given so that future changes may not be found necessary.

There tends to be more or less of a diversity of interest between the company and its consumers in the determination of the amount of gross revenue which the company is to be allowed to receive for its services as a whole. Such diversity of interest, however, does not, or should not, exist, in the establishment of the various schedules which are to apply in giving the company its agreed upon revenue.

From the consumer's standpoint, first of all, good service is the prime requisite. This being accomplished, it is reasonable to assume that the consumers as a whole are best satisfied when the system of rate schedules, for the various classes of service, results in a charge for each class as nearly as possible in proportion to what the service is worth to that class. Such a system of rates will naturally tend toward the greatest possible development of the use of the central stations' service. This, in turn, results in a lower unit cost of rendering the service, which, in its turn, makes possible a further increase in net revenue for the company and a reduction in rates for the consumer.

It is readily seen that the central station's interests in this respect are identical with those of the consumer, i. e., it is of mutual interest to have a system of rates which will be most acceptable to the various classes, and which will tend toward the greatest development of the company's business. If there is no unwarrantable discrimination between classes, with the resultant dissatisfaction of the class discriminated against, it makes little or no difference to the central station how the revenue is divided between the classes, providing the rates are acceptable to the consumers as a whole, and also providing that they insure a total revenue sufficient to make the enterprise reasonably profitable.

There are two general basic theories on which a system of rates may be established, i. e., the cost of service theory and the value of service theory.

Cost of Service Theory.

The cost of service theory, as its name implies, aims to charge each individual consumer directly in proportion to the cost of serving that consumer. Such a basis would seem to be the most equitable and proper for the charges of any public utility, and, the-

oretically, this is no doubt true. It is found, however, in the practical application of rates, that there are a number of other factors which must be considered.

Perhaps the most direct application of the cost of service theory is found in the differentials allowed for quantity, load factor, time and character of demand, minimum charge, etc. Even these differentials, however, are often governed to a certain extent by the value of the service to the consumer.

Owing to the multiplicity of factors entering into a determination of the exact cost of rendering service under varying conditions, it naturally follows that a certain amount of averaging must be resorted to for the sake of simplicity in the expression of the rate schedules. Under the cost of service theory we have, at one extreme, the attempt to differentiate in proportion to the exact cost to each individual condition of service. This must necessarily result in a schedule so complicated as to be entirely impracticable. At the other extreme we have a general average or uniform rate to all consumers based on the general average cost of rendering service to all consumers. Where the conditions of service and the cost of supplying service vary to a considerable extent, as they do in the case of electric light and power service, a general average rate per kw.-hr., per lamp, or per day, naturally results in a degree of inequity between individual consumers which the central station is unable to justify. Such an average rate would also tend to retard the development of the company's business, to the detriment of the community as well as to the company itself. Only in cases of complete monopoly have uniform rates been found to work out satisfactorily, the United States Postal charges being, perhaps, the best example of this form of rate. Even here it is to be noticed that in the Parcel Post division, which is in competition with the express companies, zone differentials are resorted to, the uniform flat rate applying principally to first class mail, where the government has an absolute monopoly, competition being prohibited by law.

As a compromise, therefore, between the extremes of the complexity of individual cost of service and the inequity of average cost of service, the trend of commission and court decisions seems to be toward averaging, more or less arbitrarily, the various classes of service, that is, basing the rates for each class on the average cost and average condition governing that class as a whole.

Value of Service Theory.

The value of service theory, as its name implies, contemplates the value of the service to the consumer as the proper basis on which the charges should be made. This basis has undoubtedly predominant influence in the establishment of prices in other lines of business, and it bears no small part in the consideration of the proper charges for electric light and power service as well.

This theory, of course, when carried to extremes, is quite apt to result in an unreasonable charge to those consumers who have no other alternative but to use the company's service at what ever rate may be demanded. Aside from this extreme condition, however, the value of service theory is a very important factor in establishing a proper schedule of

charges, especially in its influence toward the encouragement and development of the use of the central station's service.

In a consideration of the value of service theory, there are found to exist two general classes of business, usually termed competitive and non-competitive. This classification is, of course, under the assumption that the light and power utility has no direct competition from another utility of the same class.

Competitive Business.

In the competitive class, come first the large office buildings, hotels, factories, mills, and other large units which are in position to consider the installation of an independent electric plant. The value of the central station's service to such consumers is necessarily governed by the cost at which the consumer can furnish electric service from a plant of his own. We also have, in the competitive class, those consumers who can use steam or gas engines for power, and gas, oil, etc., for lighting.

The latter forms of competition are not quite so direct as the independent electric plant first mentioned, inasmuch as they do not always completely replace the value of the central station's electric service to the consumer. Under these conditions, the cost to the consumer to furnish his own service by means of these various substitutes does not quite so directly control the value of the central station's service to the consumer and consequently the central station's rate necessary to get the business.

Non-Competitive Business.

The strictly non-competitive consumers of an electric light, power and heat utility are decidedly scarce, as there are very few requirements of light, power and heat, which cannot, in the event of unreasonable electric rates, be filled in some other form. The commercial department of any electric utility is well aware, even though it has no direct electric competition, that its business is far from being a monopoly, as is popularly supposed. There are, however, undoubtedly a number of consumers to whom electric service is of such additional value in furnishing light, power and heat, that they are willing and able to pay a rate considerably higher than the other forms of service would cost. Theatres are perhaps the best example of this class.

Numerous non-competitive conditions can be found outside of the electric light, heat and power utilities, such as in the case of water supply, transportation, and last but not least, the United States Postal Service, in the latter case competition being strictly prohibited by law.

In the establishment of a schedule of electric rates for these various non-competitive and competitive consumers, we have, in the first case, the limitation that the rate charged to the strictly non-competitive consumer must be reasonable and be governed by the cost of serving such a consumer. In the second case, the rates offered to the large competitive consumer should be at least sufficiently high to pay something more than the direct additional cost of serving such a consumer, or the increment cost, as it is sometimes termed.

Differentials to Meet Competition.

There seems to be a diversity of opinion as to the equity of charging these large competitive consumers less than their full pro rata of the total cost of serving them, including all fixed charges. It is contended by the opponents of this method of charging that it discriminates against the non-competitive consumers, inasmuch as they must necessarily be charged more than their pro rata of the cost of service to compensate for the low rates which must be made to the competitive consumers to get the business.

The fact remains, however, that if this principle were not applied, a large amount of competitive business could not be obtained, with the result that the non-competitive consumers would be obliged to carry the entire burden of that large portion of the fixed charges and operating expenses which remain practically constant, regardless of whether or not the additional competitive business is on the system.

In the case of railway rates, this principle has been established for a number of years in the form of the so-called "Pacific Coast Terminals Rates" designed principally to compete with water transportation. Even after the adjustments now contemplated by the Interstate Commerce Commission and the United States Supreme Court have been effected, this principle will continue in a modified form.

Feature Rates.

The value of service theory is often quite prominent in the classification of the various forms of service.

Most central stations usually have one or more so-called feature rates, which have, as their object, the development of electric service along certain lines, such as cooking, heating, and various forms of domestic power.

With the present state of development of electric cooking and heating appliances, it is evident that a given quantity of electric energy, when used for cooking and heating, has not as high a value to the consumer as when used for lighting with the modern high efficiency lamps. In recognition of this fact, we have the low rates of 5c, 4c, 3c and so on down to the one cent rate which has been offered by some English companies, aiming towards the encouragement of the domestic use of electric energy for cooking, heating and power purposes, while at the same time, a materially higher rate exists for lighting service.

There may be some attempt to defend this differential from the "cost to serve" standpoint, on the ground that cooking and heating are off-peak loads. If special circuits are run for this class of load exclusively, and the service is actually cut off during the station's peak, a considerable differential between lighting and heating can, no doubt, be justified, purely from the "cost to serve" standpoint. In actual practice, however, cooking and heating services on this special rate are quite often taken from the lighting mains, and, while more or less of the domestic cooking and heating consumption of energy will perhaps occur during the off-peak period, the fact remains that when service is rendered under the condition just mentioned, (which is quite common among central sta-

tions) a large part of the maximum demand of the cooking and heating appliances will often come directly on the central station's winter peak, between 4:30 p. m. and 6:00 p. m. Under these conditions the differential can hardly be based on other than the value of service theory.

A similar condition exists in other forms of lighting and power feature rates, that is, the value of service is practically the only valid reason for the differential in the rates charged for two or more classes of service furnished under practically identical conditions. A good example is the lower rate for power service furnished from underground direct current systems, where the power and light are delivered from the same mains and through the same service cables.

In calling attention to these conditions it is by no means the intention to infer that such a differential should not exist. It is quite evident that attractive prices must be offered for certain forms of heat and power, especially during the development stage, in competition with other forms of furnishing the required heat and power.

Outside the electric industry, a very good example of the value of service theory is shown in the rates charged for Pullman berths. The investment in an upper berth is considerably higher than in the equipment necessary to convert the seats into a lower berth, and, on the cost of service basis, would call for a higher charge than the lower berth. In practice, however, the desirability or value of the lower berth to the traveling public is so much greater than the upper berth, that the rates have been made approximately 20 per cent lower for the upper berth. This differential in the price of the upper and lower berths was ordered by the Interstate Commerce Commission (20 I. C. Reports, 21 to 32).

The attitude of various Commissions and Courts toward the value of service theory may be found expressed in the following:

Interstate Commerce Commission.

"Railway Rate Theories of Interstate Commerce Commission," by M. B. Hammond, pages 181, 182, 186, 187, 529.

Massachusetts Board of Gas and Electric Light Commissioners.

Massachusetts Gas and Electric Reports 1909—33, 42 to 47.
Massachusetts Gas and Electric Reports 1910—20, 50, 51.
Massachusetts Gas and Electric Reports 1911—29, 30.
Decision 6/7/1913 re Marblehead Municipal Plant's application to reduce rates.
Decision 5/24/1913 re Westfield Municipal Plant's application to reduce rates.
Decision 7/28/1913 re complaint against Edison Electric Illuminating Company of Brockton, Mass.

Michigan Statutes.

Public Acts 1909, No. 106, Sec. 7.

California Railroad Commission.

Town of Willets vs. Willets Water & Power Company, Case, No. 297.

New York Public Service Commission, 2nd District.

Decision 4/2/1913 in re Complaint of Mayor of Buffalo vs. Buffalo General Electric Company.

Supreme Court of New Jersey.

Decision 7/7/1913, Public Service Gas Company vs. New Jersey Board of Public Utility Commissioners, 87 Atlantic 651.

Wisconsin Railroad Commission.

City of Beloit, 1910, 5 W. R. C. R. 632.
Ripon Light and Water Company, 1910, 5 W. R. C. R. 45.
Decision 11/14/1913 re Application of Neshkoro Light and Power Company to increase rates.
Decision 8/4/1913 re Complaint against Milwaukee Gas Light Company.

It is therefore seen that while the cost of service is, perhaps, theoretically the most proper and equitable basis on which to establish the central station's charges, and is generally accepted as the primary basis

of rate schedules, such a basis must often be considerably modified, not only for the sake of simplicity in the expression of the schedules, but also by the commercial and economic considerations of the value of the service and the development of the business.

Various public utility commissions, courts and other authorities give recognition to both these theories, and the general trend of opinion and decisions seems to be towards the cost of service as a primary basis of rates, modified, however, by the value of service theory.

Individual rates in a system of charges may sometimes fall entirely under one of these theories, to the complete exclusion of the other theory. The differential between the upper and lower Pullman berth rates is such a case, the cost of the service being entirely ignored in the establishment of the differential.

At the other extreme, we may cite, as an example, strictly off-peak rates which are offered for any form of use which the consumer may desire.

These are rather extreme cases, however, and an analysis of the rate schedules of almost any central station will indicate that both theories are usually taken into consideration.

A brief discussion of the various forms of rates now used by central stations is pertinent to the subject. The Rate Research Committee of the National Electric Light Association has devoted no small part of its efforts towards the standardization of the form of rate schedules, and a step in this direction is a consideration of the advantages and disadvantages of the various forms of rates.

The writer has in mind the following nine distinct types of rate forms which will be briefly discussed:

No. 1. Flat Rate.

The chief objection to this form of rate is the waste of energy which is quite apt to occur, especially in the case of lighting loads, and its consequent effect not only on the operating costs (where a large part of the generation is by steam), but also on the diversity factor. In the case of lighting rates, the waste may be checked to some extent by requiring the consumers to use Mazda lamps and furnish their own lamp renewals. With the constantly decreasing price of lamps, however, and the increasing useful life, this can hardly be expected to act as a sufficient incentive to the average consumer to be economical in the use of the service on a flat rate basis. Such a rate is often far from the cost of rendering service to the individual and must necessarily be a more or less inequitable average price. If not confined to a rather narrow range of operating conditions or class of consumers, an average flat rate will have a tendency to retard the development of the use of the central station's service, as it will often be too high to obtain business which can be carried profitably on a rate lower than the average.

For example, the central station may have in effect a load factor rate or some other differential form of rate for residences which would result in a low rate for heating and cooking appliances. The average revenue derived from this rate might be 10 cents per kilowatt hour. If the company replaced such a rate with a straight rate of 10 cents per kilowatt hour the

future development of the heating and cooking load would be considerably handicapped.

First among the advantages of a flat rate is the simplicity of expression, which is always desirable, especially for residences. Such a rate is perfectly satisfactory where the company has control of the service, as, under this condition, the amount of service rendered and consequently its cost and value, can be definitely determined. Municipal street lighting is, perhaps, the best example of this. Similar service is rendered for sign lighting, show window lighting, etc. For the latter purpose a flat rate of so much per lamp per month is a very good way to insure a good load factor and a proper maintenance of the lamps, as a flat rate charge can, of course, be made to include long hour burning and proper maintenance by the company. The maintenance feature is usually desirable to the consumer, especially when there is an accident risk involved in renewing the lamps. Another big advantage of such a rate is that it does away with all meter expense, which is a very large item in small residence lighting, including, as it does, investment and depreciation charges on the meter, periodical calibration, and reading. The meter expense alone may represent 25 per cent of the total cost of serving a small residence consumer.

A flat rate also makes practical the collection for service in advance, as is often done by telephone and water companies. In dealing with some classes of consumers, this is a decided advantage in avoiding credit risks, and where large amounts are involved the interest item alone for the current month is of no small consequence.

The unit taken in making a flat rate charge is rather immaterial, provided it is something definite and tangible that the consumer can readily understand. So much per lamp, or other unit of equipment, is perhaps the best. The schedule covering different size units can, however, be considerably simplified by charging so much per watt. The present practice of designating lamps in terms of watts rather than candlepower, as formerly, has resulted in the wattage basis being generally understood by all classes of consumers.

Perhaps the most notable use of flat rates for uncontrolled service is in Hartford, Connecticut, where the Hartford Electric Light Company has for some time successfully served a large number of small residence consumers on the basis of so much per lamp per month, the only requirement being that Mazda lamps be used. This company, however, recommends that service of this nature be limited only to the smallest consumers, where the meter expense would be almost, if not altogether, prohibitive.

Following are some references to opinions on flat rate charges:

Wisconsin Railroad Commission.

Ripon Light and Water Company, 1910, 5 W. R. C. R. 34.
Durand Light and Power Company, 1910, 6 W. R. C. R. 334-348.
City of Rhinelander vs. Rhinelander Lighting Company, 9 W. R. C. R. 406.

District Court, Eastern District of Idaho.

City of Pocatello vs. Murray et al., 5/16/1913, 206 Fed. 72.

No. 2. Straight Meter Rate.

The chief argument against this rate is that it is not proportional to cost, and, like the flat rate per unit of equipment, has the disadvantage of any rate

which strikes a general average. A differential for quantity will, however, considerably improve such a rate for application to a class of load with comparatively narrow range of individual demand. Compared with the flat rate per unit of equipment, it has the disadvantage of requiring an investment in and operation of meters.

Simplicity stands perhaps first in the advantages of this form of rate. Also, on a meter basis, unnecessary waste is prevented. With a proper differential for quantity, and a suitable minimum charge, such a rate is very satisfactory for residence business, as the individual demands of this class of load are between such narrow limits, and the diversity factor is usually so high, that a differential for demand is hardly necessary, and only serves to confuse and irritate the consumer.

Following are some references to opinions on straight meter rates:

Wisconsin Railroad Commission.

Ripon Light and Water Company, 1910, 5 W. R. C. R. 34.
Red Cedar Valley Electric Company, 1911, 6 W. R. C. R. 717, 758, 759.

Massachusetts Board of Gas & Electric Light Commissioners.

Edison Electric Illuminating Company of Boston, Mass. G. & E. R., 1909, 44, 45.

Arizona Corporation Commission.

Decision 7/9/1913 Establishing Straight Meter Rates for Tucson Gas, Electric Light and Power Company.

Montana Public Service Commission.

Decision 11/3/1913 Establishing Straight Meter Rates for Helena Light and Railway Company.

Georgia Railroad Commission.

Decision 2/24/1914 Establishing Straight Meter Rates for Macon Railway and Light Company.

Illinois Public Utilities Commission.

Decision 5/6/1914 Approving Straight Meter Rates for Western United Gas & Electric Company.

No. 3. Straight Demand Rate.

By a straight demand rate is meant a rate of so much per kilowatt or other unit of demand per year, or per month. Such a rate has practically all the advantages and disadvantages of the previously mentioned flat rate, with the difference, however, that, being based on the actual demand, it comes nearer to being proportionate to the cost of service than does a rate based on the unit of equipment, or, in other words, on the connected load. Such a rate has the advantage of being simple in expression, making possible advance collections, and enabling the consumer to know definitely, in advance, the cost of the service to him. This is often desirable, especially in contracting work. Such a rate can, and is often applied advantageously to irrigation, as the demand requirements can usually be quite definitely ascertained in advance, as well as the operating conditions, such as load factor and time of peak. As with the flat rate, the kilowatt hour meter expense is also eliminated.

[To be continued.]

Electrical resistance ceases at the absolute zero, as has recently been experimentally proven by Prof. K. Omnes, who has produced a temperature of 271.8 degrees below zero Centegrade by the rapid evaporation of liquid helium. A coil of one thousand turns of fine insulated lead wire with terminals joined was immersed in a bath of liquid helium placed between the poles of an electromagnet. The removal of the magnet induced $\frac{1}{2}$ ampere in the coil, the current continuing to flow as long as the coil is kept in the liquid helium.

ELECTRIC DISTRIBUTION

STANDARDS AT SAN DIEGO.

D. Overhead Construction.

BY L. M. KLAUBER.
[Continued.]

E 50, E 60: Weights, Case and Oil Data. This information is approximate only and is inserted for the assistance of storeroom and yard men in making up truck loads.

E 70: Wiring Diagrams. These, covering substa-

tions, banks and boosters, conclude the information on transformers. Only a few of the many possible booster connections are shown, as it is deemed better to accompany each work order with diagrams where special connections are required.

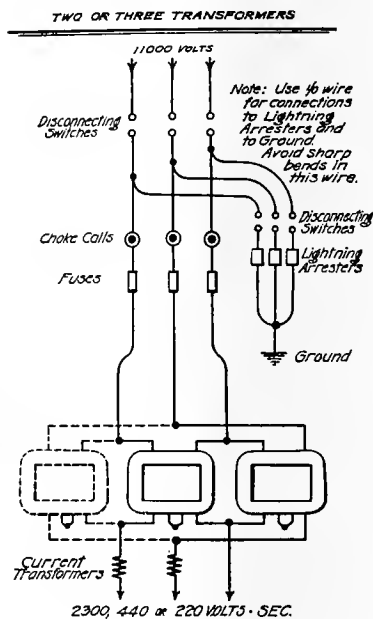
G. E. TYPE 'H' TRANSFORMERS
CASE NOS. AND OIL REQUIRED

SIZE KVA.	FORM K SQUARE	FORM K ROUND	FORM H ROUND
	CASE NO.	OIL	CASE NO. OIL
1	CP-03	6 QTs.	CP-3 8 QTs.
1.5	CP-05	7 "	CP-4 3 "
2	CP-07	9 "	CP-7 11 "
2.5	CP-09	10 "	CP-9 13 "
3	CP-11	13 "	CP-11 14 "
4	CP-13	16 "	CP-13 17 "
5	CP-15	21 "	CP-15 20 "
7.5	CP-17	32 "	CP-17 25 "
10	CP-19	40 "	CP-19 30 "
15	CP-21	68 "	CP-21 48 "
20	CP-23	88 "	CP-23 55 "
25	CP-25	116 "	CP-25 77 "
30	CP-27	135 "	CP-27 105 "
40	CP-29	170 "	CP-29 155 "
50	CP-31	225 "	CP-31 190 "
75	OS-33	220 "	CP-32 196 "
100	OS-36	240 "	
125	SK-024-55	320 "	
150	CP-36-48	360 "	
200	CP-37-60	480 "	

SIZE KVA.	FORM KIN SUBWAY	FORM S 11000 V.
	CASE NO.	OIL
2.5	CP-115	20 QTs.
5	CP-117	25 "
7.5	CP-119	30 "
10	CP-121	50 "
15	CP-123	55 "
20	CP-125	75 "
25	CP-127	105 "
30	CP-131	190 "
40	CP-133	180 "
50	SK-024-45	200 "
75	S-135	312 "
100		420 "
125		528 "
150		712 "

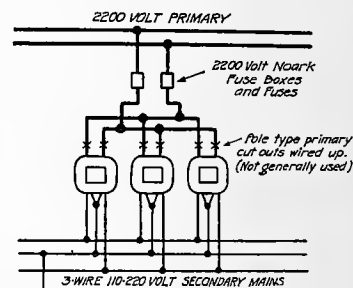
E 60.1

WIRING DIAGRAM
11000 VOLT-THREE PHASE
SUBSTATION



E 70.1

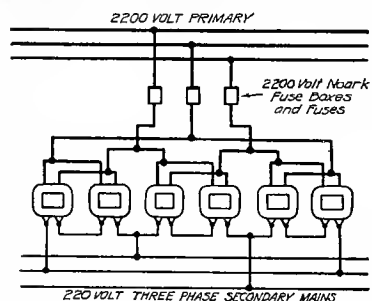
BANKING SINGLE PHASE TRANSFORMERS
IN LARGE INSTALLATIONS



Place no fuses in individual leads to separate transformers. Pole type primary cut outs wired up with copper wire may be placed at these points if desired, to serve as disconnecting switches, but are of no service unless the secondaries of each transformer may be easily disconnected from the secondary mains, since the transformer is not 'killed' unless both primary and secondary are disconnected.

E 71.1

BANKING 3-PHASE TRANSFORMER STATIONS
IN LARGE INSTALLATIONS

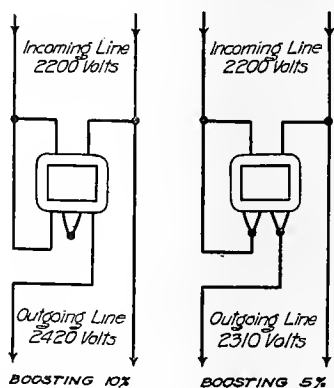


Where 440-volt three-phase secondary is desired, connect secondary of each transformer in series, instead of parallel as shown above.

Where the transformers used have the ratio 2200/220-440 and a 440-volt secondary is required, connect the secondary of each transformer in parallel for 220 volts and connect two transformers in series across each phase as shown in above sketch. This is preferable to connecting each transformer secondary in series for 440 volts and then connecting two transformer secondaries in parallel across each phase.

E 71.2

SINGLE PHASE BOOSTERS

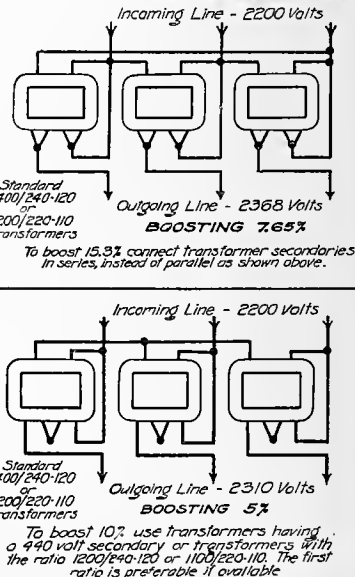


Notes:

Place no cut outs in primary of booster transformer.
If above connections are found to buck instead of boost, reverse the primary leads. Above figures will be correct for transformers of standard polarity.
Transformer used is standard 2400/240-120 or 2200/220-110 volts. In choosing size, rated full load amperes of secondary as connected should be slightly greater than the estimated load of the outgoing line.

E 72.1

THREE PHASE BOOSTERS



PLACE NO CUT-OUTS IN THE PRIMARIES OF BOOSTER STATIONS

E 72.2

ELECTRIC HEADLIGHTS.

BY A. G. JONES.

(The factors leading up to the use of the nitrogen filled lamp for locomotive headlight use are thoroughly discussed by the author who was largely instrumental in the adoption of this form of headlight in Nevada. This paper was presented at the meeting of the Nevada Industrial Safety Association on September 7, 1914.—The Editor.)

Modern engineering, be it electrical, mechanical, mine or any other other phase, is embracing a steadily increasing factor; namely—safety. Anything which tends to reduce accidents is largely investigated and utilized, if possible, in modern practice. One of the most effective safety tools is light.

The advance of the art of the production of artificial light has been very rapid during the past few years. New forms of illuminants have been invented and wonderful improvements made in old types. Of the latter the incandescent lamp stands unquestionably at the head. It was but a few years ago that the 16 candlepower carbon lamp, consuming 56 watts of power, was practically the only incandescent lamp available in commercial quantities. Today we have the tungsten filament Mazda lamp in units of from $\frac{1}{2}$ to 2000 candlepower. This range allows of application to practically all fields of human activity. Some of these lamps, consuming but 8 watts, instead of 56, for every 16 candlepower emitted, together with the steadily decreasing cost of power, allow the use of a profusion of light for all operations. This has resulted in the prevention of many, many accidents, particularly around moving machinery and in the various industries. The hazards of mining, for example, are being reduced by lighting the mines with Mazda lamps. Small candlepower lamps are replacing the old oil lamps, enormously reducing the possibility of explosion; large lamps being used to light the shafts and galleries.

With the large increase in possible applications of Mazda lamps there arose a new science; that of illuminating engineering, or the study of the production and application of light. This study has developed many new fields and new methods for old fields. Not the least important of these is that of headlights. Ever since the history of transportation began, headlights have been in use. One of the first consisted of a pile of burning pine knots pushed on a flat car in front of the locomotive.

A headlight has three important functions: First, to act as a marker on the front end of a train, warning people of the train's approach; second, to show up obstructions on the track in time to allow an engineer to reduce speed sufficiently to avert a serious accident and third, to enable an engineer to distinguish signals and other markers. The first and third require a headlight of fairly low intensity, while the second favors the use of a very powerful headlight. There is much controversy between both practical railroad men and also the theorists as to which type is better. The opponents of the powerful headlight claim that it so blinds an engineer on an opposing locomotive that he is temporarily unable to read his signals; the glaring light may so blind train men and other pedestrians around railroad yards as to completely bewilder them, often resulting in serious accidents; that under certain conditions the glaring

light thrown by a powerful headlight produces phantom signals; i. e., gives a signal the appearance of being lighted when it is not, distorts its true color, etc., by reflecting of the beam of light from the headlight. On the other hand, it is claimed a powerful headlight prevents many a collision, enables the "picking up" of distant objects, land marks, etc.

Various laws have been passed by the states to regulate this question. One state requires 300 watts at the arc; while others specify the size of the reflector. Twenty-eight states have enacted laws on the headlight subject. The wide discrepancy of these laws makes it almost impossible for a railroad doing interstate business to comply with them all. These conflicting laws have caused considerable trouble and

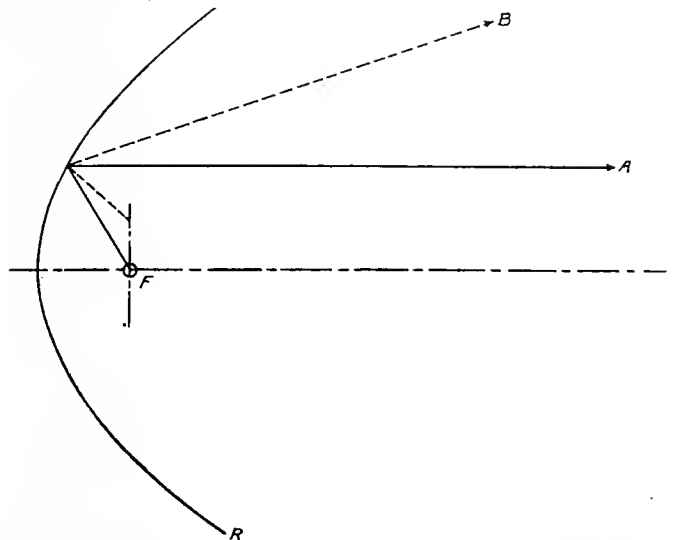


Fig. 1. Illustration of Parallel Reflection of Light Ray Originating at Focus and of Diverging Ray Originating Outside of Focus of Parabolic Reflector.

R=parabolic reflector.
A=ray originating at F.
F=focus of R.
B=ray originating outside.

there is now before Congress a bill instructing the Interstate Commerce Commission to investigate the subject.

Researches have been carried on independently, by various railroads, from which it seems that a headlight of intermediate power; i. e., more powerful than the oil, yet not so dazzling as the arc, would be advantageous. Such a headlight was offered by the incandescent lamp. With these lamps as a light source, a wide range of headlights is possible by using various sized lamps.

It is only recently that strong incandescent headlights have become practical, due to the drawn-wire Mazda lamp. By the use of drawn-wire the filament of the lamp can be wound into a very closely coiled spiral, thus enabling the light to be concentrated around the focus of the lens or reflector used in the headlight. This concentration is necessary to produce a beam of light. All light originating at the focal point of a parabolic reflector will be reflected parallel to the axis of the lamp, as ray "A" in Fig. 1, while if the light originates outside the focus it will be scattered, as ray "B"; the degree of its divergence depending upon the degree of concentration of the light source. As it is impractical to make an actual point source of light, the beam of a headlight must

necessarily diverge. In reality it consists of an infinite number of cones of light, "A," "B," etc. (See Fig. 2), the resultant beam being somewhat as indicated in Fig. 3. Taking each individual cone it may be considered as originating practically at a point, and as a whole beam is a sum of these cones at such a distance that the diameter of the headlight is negligible compared to the distance, the whole headlight may be considered as a point source of light and the intensity of beam, therefore, will vary inversely as

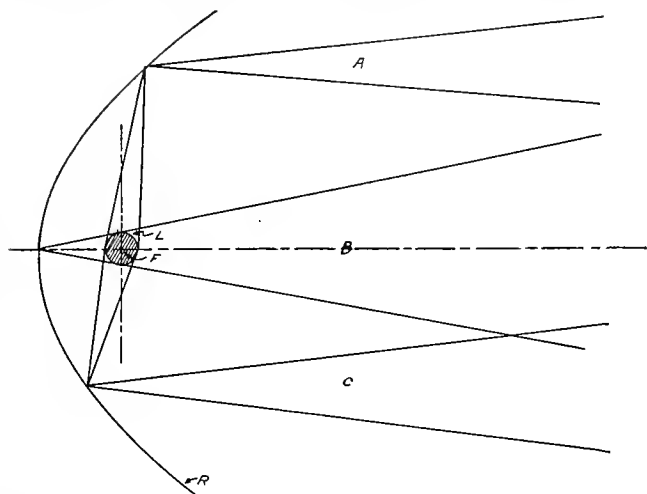


Fig. 2. Cones of Light From Spherical Light Source in Parabolic Reflector.

L=Light source.
F=focus of R.
R=parabolic reflector.
A, B, C=light cones.

the square of the distance from the headlight. This means that if a man 100 feet ahead of the light is illuminated to a certain intensity, he would receive but one-fourth this intensity if 200 feet away. Objects are seen by reflected light, which would also vary inversely as the square of the distance; hence, to show up an object equally well at 200 feet as 100 would require a headlight of sixteen times the power.*



Fig. 3. Diagram Illustrating Measurement of Intensity of Light From Searchlight.

The question of "pick-up" distance of a headlight depends not only upon the candlepower of the headlight beam, but also upon the contrast between the object and the background against which it is viewed and also upon the amount of light shining directly in the observer's eye. Tests by various railroads seem to indicate that a man in white can be discerned against a dark background about $1\frac{6}{10}$ times as far as one in grey, and one in grey about $1\frac{3}{10}$ as far as one in black. These tests also indicate that from $\frac{5}{100}$ to $\frac{1}{10}$ foot candle intensity is necessary to show up a man in dark clothes at a distance of 1000 feet. Knowing that light varies inversely as the square of the distance, one can see this means a headlight $.05 \times (1000)^2 = 50,000$ beam candlepower.

*Statement by D. F. Crawford, P. R. R. in Bulletin No. 58—Special Committee on Relation of Railway Operation to Legislation—P 3-8 L-31.

The ordinary oil lamp has a beam candlepower of about 800-1000, while that of the arc headlight may run as high as 1,000,000. Between these come the incandescent headlights which can be made of almost any candlepower desired. The incandescent lamps used in these headlights are low voltage lamps for two reasons; first, because a low voltage filament can be concentrated into a smaller space than a high voltage, due to the long wire necessary to obtain the proper resistance for the latter; and, second, to obtain greater mechanical strength. Six volt lamps are made of 51, 106 and 166 candlepower. Tests by the Southern Pacific Railroad have shown that with a 6 volt lamp of 140 candlepower, in a 20-inch parabolic reflector of $\frac{2}{34}$ inch focus, a man in dark clothes could be picked up 1800 ft. ahead of the locomotive. Six volt headlight lamps are being operated by storage batteries, and there are also under construction a number of 6 volt turbo generator outfits for this purpose. Where 34 volt outfits, in common use with arc headlights, are already in service, 34 volt incandescent lamps are available. As the filament is not so concentrated in these, the beam has greater spread and is considerably less powerful for equal wattage consumption.

The question of spread is another one which enters in as well as the maximum intensity of a beam. How shall a headlight be rated? If it is rated in pick-up distance, no two calculations are liable to be exactly duplicates. If it is rated in beam candlepower, or what is the same thing—its ability to deliver a certain foot candle intensity at a certain definite distance—it may have very little spread i. e., it may be but a pencil of light obviously not sufficient for a good headlight. Probably a combination of the two will be the best; i. e., a rating giving the average beam candlepower over a definite angle, measured at 200 or more feet from the headlight.

Headlight beams are measured by placing the training the beam on a wall or other normal surface lamp exactly in focus (this is easily accomplished by at a distance of several hundred feet and adjusting the focusing device until the smallest spot of light is obtained on the wall) and then measuring the intensity with a portable photometer at a distance of several hundred feet. Foot candle readings are generally taken every foot across the beam on a plane passing through the center of the beam. These readings plotted give the illumination distribution curves of the headlight (Fig. 4.)

The performance is also frequently given in beam candlepower, which is obtained by averaging the values at corresponding distances from the center of the beam; i. e., the foot candles at 2 feet to the left and 2 feet to the right of the center, etc., and multiplying this figure by the square of the distance from the photometer to the headlight. This will give the beam candlepower and plotted, will appear as in Fig. 5. If the maximum candlepower of the beam is found to be 100,000 and the candlepower of the bare lamp itself is 100, the ratio of these two; i. e., 1000, is called the multiplying factor of the equipment.

The incandescent headlight has many advantages. Once the light source is located at the focus of the lens or reflector, it will remain there until the lamp

burns out. This produces a steady beam of good color, which will stay on the track. No attention is required, except the replacement of burned-out lamps. The headlight can be made air-tight, thus retaining a high polish on the reflector. Headlights can be very easily dimmed when approaching an opposing locomotive or when entering terminals; thus the incandes-

personal calls. At the end of each interview if your services are not needed, tactfully inquire if the person you are calling upon can suggest anyone who might need your services. Make a careful note of any suggestions or addresses and then follow up these also.

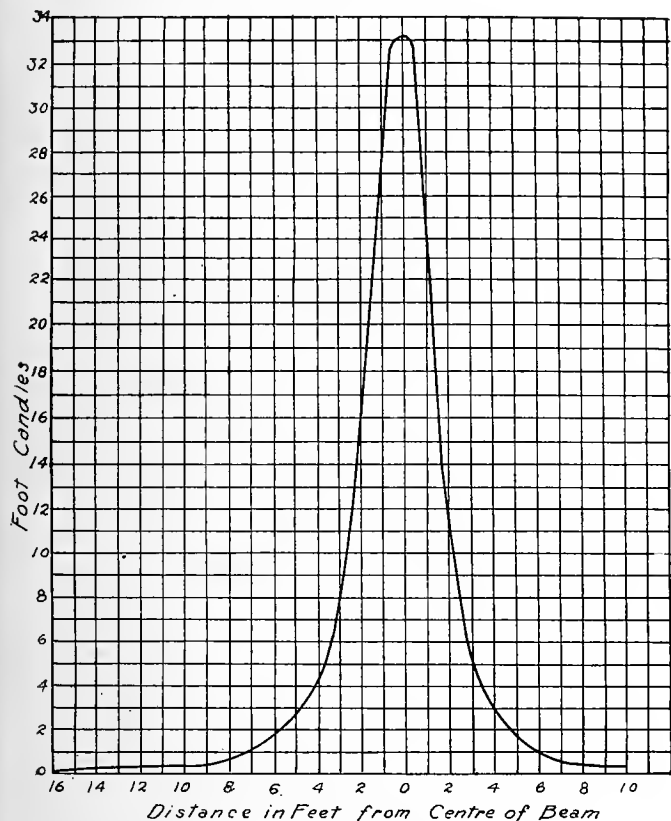


Fig. 4.

Distribution Curves Across Center of Beam at 170 ft. Radius. 6-Volt 151.3 c.p. Single Helix Mazda Lamp in J8 Locomotive Headlight Equipped with 19 5/16 in. Parabolic Reflector of 2 3/4 in. Focus. Multiplying Factor, 6340.

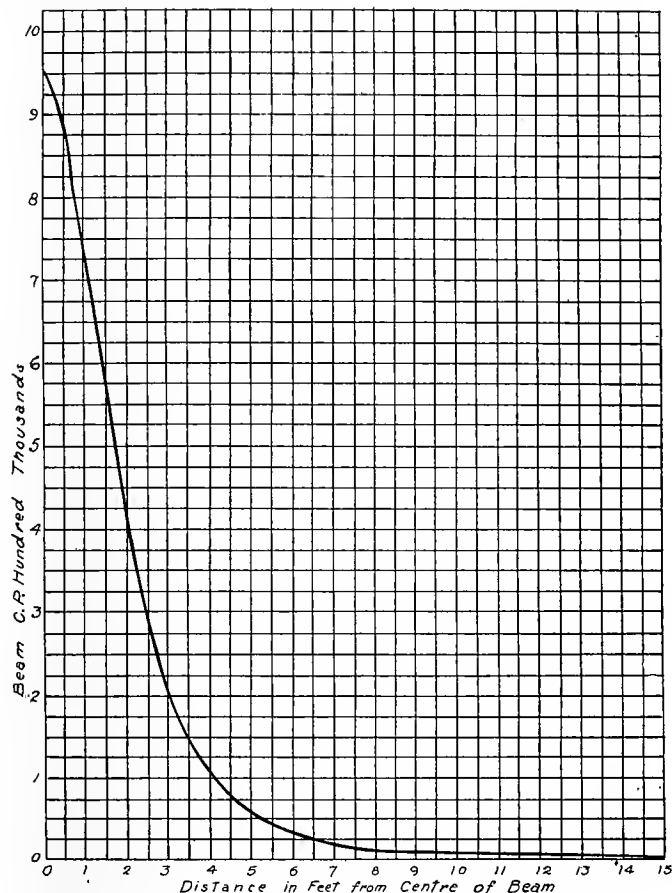


Fig. 5.

cent headlight is simple in construction, installation and maintenance, also reliable.

HOW TO GET A JOB.

BY FRED A DIBBLE.

1. Make a list of the names of the firms for whom you are qualified to work.
2. Write a letter of application stating specifically what you are qualified to do by reason of—
 - (1) Taste or natural inclination.
 - (2) Education or general training.
 - (3) Experience or special training.
 - (4) Give references as to:
 - (a) Where you have worked during your working life.
 - (b) Character references.
 - (c) Social references.

Spend enough time in preparation of this letter to give your story essentially complete in fewest number of words.
3. Typewrite or have typed for you 1, 5, 10 or 20 copies of this letter each day until you have exhausted your list or have secured your job.
4. Put in the remainder of your time following up these letters and the answers they bring by

5. Require of yourself that you send out regularly each day the number of letters that you have set as your stint.

6. Advertise:

- (1) Place an advertisement in the Situation Wanted Department of the Trade and Class papers touching the field you desire to enter.
- (2) Use the daily papers if you can afford it.
- (3) Answer ads which seem to fit your qualifications in all these papers.

7. Write to your old employers, frankly stating what you want to do. They may be able to help you with advice and suggestions.

8. Let as many people as possible know what you want to do. Believe all the time that everybody wants you to have a good job.

9. Take especial pains to keep up your personal appearance. Your person and clothes should receive extra care.

10. Keep up your spirits by belief in yourself, and carry an air of optimism and good-will toward everybody. And keep your eyes and ears open and your mind so fully occupied that you will have no time to become discouraged.

PATENTS A PROFITABLE FIELD.

BY GEO. J. HENRY.

(After defining patentability and the procedure in patenting an invention, the author shows the limitations which accompany carelessly drawn claims. Mr. Henry is a consulting engineer at San Francisco now specializing on patent application.—The Editor.)

A patent issued by the United States is a grant under authority of Congress of certain exclusive rights to an inventor in exchange for his fully disclosing his invention so that one skilled in the same art can construct the patented device. Contrary to the popular belief, patents in the United States are not issued to cover everything. They are issued only for a new and useful machine, manufacture or composition of matter or a design or any new and useful improvement thereon. The application consists of a petition to the Commissioner of Patents requesting the issue of letters patent, a specification which consists of a full and complete description with a drawing or drawings of the invention and claims or detail descriptions of those elements and their manner of association which cover the invention.

The examiners in the patent office are experts, each familiar with a particular branch or classification of the patent office records, and they have access to a complete collection of records with the subjects all properly classified and indexed and cross indexed so as to facilitate a search in an effort to determine the novelty of the invention under consideration.

A patent will not be issued for an invention that will not work, nor for one that would be dangerous to the public interests, as neither of these would be useful. Aside from a few limitations of this nature and including also inventions claiming perpetual motion, the question of usefulness is usually left largely to the inventor, his allegation that it is useful being sufficient; the inventor himself being conceded to be a good judge of this.

The determination of whether or not the invention is new is, however, one that cannot so well be determined by the inventor, although he must make oath that he is the inventor and believes it was unknown until his invention. The patent office therefore makes a thorough search in an effort to discover whether or not the invention was previously known and therefore public property—for that which already belongs to the public cannot be withdrawn in favor of an individual.

The search made by the patent office frequently, in fact usually, uncovers a number of previous inventions in foreign countries as well as in the United States patent office which, in a measure, or wholly, anticipate the device covered by an applicant's specification. The applicant then must make it clear wherein his invention is a further new and useful step in the art over the references which the examiner cites against him, and after these anticipating inventions have been explained away to the satisfaction of the patent office, or certain claims withdrawn, or abandoned, the patent will be issued in its restricted form. The applicant may find that all he thought was new and maybe did in reality independently invent, was not new, some or all of it having been previously in

public use or fully described in a printed publication more than two years before his application.

The statutes recognize that to bring an invention into a sufficiently developed form to cover by patent requires time and that while an inventor is working at his improvements others may make public his invention. The original inventor is, however, the one to be protected over others. He must exercise diligence in bringing his invention to a perfected state, even though he may not be the first to apply for a patent thereon, or the first to disclose his invention to the public. This of course calls for a nice discrimination on the part of the patent examiners and courts in the determining of the rights of each of two or more conflicting applicants in the patent office and even though a patent may have issued to one party, a second patent may be obtained by the original inventor upon proving priority and diligence.

The claims of the patent are a description in the shortest, clearest words of the invention. The broader the claims, the larger the range covered by the wording of any claim, the larger the field of exclusive rights granted the inventor. All the matter covered by the valid claims must be perfectly clear to one skilled in the art upon reading the specifications and drawings.

The theory upon which the patent is granted is that an inventor of something new and useful should be encouraged to give the products of his mind to the public for their improvement and benefit and that he should therefore be encouraged to invent and disclose, and as compensation for this, there is reserved to him for his exclusive benefit the right to deny all others a right or rights to his invention for a period of seventeen years, after which, the invention as fully disclosed in the specifications and drawings, becomes the property of the public and no further rights are allowed the inventor. This, at first thought, seems rather unfair, but if the inventor has availed himself of the seventeen years protection of his patent, and he has something really new and really useful he may have acquired such a position that competitors can scarcely assail him. Such an example is before us in the telephone interests of the United States—this gigantic industry having been built up largely on patents.

It must be noted that a patent may be primarily considered as granting to the patentee or his assigns the right to deny others the right or rights to his invention. This is most important. It follows that an innocent but original inventor who does not apply promptly for a patent runs the risk of others doing so and receiving a patent under which he may be estopped from the manufacture of devices of which he was the real inventor. It is therefore absolutely necessary especially in a mechanical business to protect each inventive step to prevent others from interfering with the growing business. This course is regularly pursued by the large progressive electrical companies and others who employ experts for the sole purpose of inventing and covering inventions with patents. It will thus be seen that many large business aggregations are protected by the patent law, and it is just this protection that has secured supremacy for American manufacturers.

It is true that there are many patents issued that are of no value and are a source of expense to the inventor instead of profit, but this is not the fault of the law. It is to be assumed that unless the inventor thought he had something worth the investment he would not make the application. A patent may be so restricted in its claims that any one skilled in the art to which it belongs can readily avoid the claims and still use the best part of the inventions, and it is just here that a patent attorney is in a position to be of the greatest service to the inventor. The claims are what really determine what protection is to be afforded the inventor and he is not protected on any thing not set forth in the claims. Patentees sometimes overlook this fact and think they will be protected on the entire device as shown in the drawings. This is not so. For example, an inventor might apply for a patent on a registering and counting device for a printing press and show in the drawings accompanying his application a full printing press with his device thereon but he would be restricted to claims only on the particularly new features. Patentees are frequently disappointed to find the limitations of their patents, and it is to be regretted that there are many patent attorneys who depend on following conventional methods and who are so little posted on mechanics and technical matters generally and thrive at the expense of the inventors who know nothing of the patent office practice.

If an application is drawn broadly and so as to really be of value if the patent issues the broad claims are likely to be rejected on the first action by the patent office, and it then becomes the function of a conscientious attorney to endeavor to bring the examiner to view the rejected broad claims in the light of patentable invention. This frequently takes much time and correspondence but the results always warrant this effort and time and where the inventor is satisfied with the good faith and competence of his attorney, the extent of the patent office rejections and attorney's arguments is no detriment to the patent when issued or to the inventor's rights.

The patent office allows one year for replies and actions on the applicant's part to actions by the office before construing them abandoned, and some attorneys make a practice of waiting almost the entire year, this on the theory that the longer a case is kept in the patent office, the longer will the applicant be allowed protection as the patent grant of seventeen years does not commence to run until the patent issues although the patentee is protected from his date of invention.

It frequently happens that it is an advantage to delay the issue of the patent, and in such cases, this course is admissible. Generic patents in aeronautics would probably net the inventor more if so delayed, as the world has not yet grown up to the state of providing a large absorbing market to make the patent a remunerative one.

If when Father Stonehatchet invented the wagon wheel he had recourse to patent protection, it would have been a great advantage to have delayed the actual issue of his patent until such time as civilization would have found the wheel of great value, as for example, in the conquests of Alexander. This

extreme case is cited to show the principle only and also to point that modern civilization is dependent to an enormous extent on discovery followed by invention, for the discovery of the circle and the fact that its center would travel parallel with a straight line on which the circle rolled was a discovery much earlier than its adaptation to a wagon body for simplifying transportation, which adaptation was an inventive act.

In contradistinction to this course, it must be borne in mind that today a generic invention is something extremely rare. The selenium cell for wireless telegraphy is one probably within the memory of most of us, and therefore almost all inventions are of a restricted nature. As a useful art to which an invention belongs becomes more highly developed, there are a greater and greater number of inventions patented, but the extent of the patent or at least, the protection it affords, is of a more and more limited extent and not infrequently the details of any particular device may be changing every few years so that nothing is to be gained by delaying the issue of a patent and the inventors interests demand its issuance at the earliest possible date, such for example, would be a skirt hanger or hat pins, where the mandates of style would otherwise outrun the actions of a slow attorney, and competitors would infringe, collect their profits, disburse their funds, dissolve their organization and start anew before the inventor would receive his patent and have a basis to sue infringers.

The value of good patents is great when properly handled after issue as well as during the application period and the subject is one of profit that many scientific minds are overlooking. In our highly organized civilization, the development of the inventive faculty has brought within the range of usefulness a myriad discoveries that had lain fallow through the centuries before, waiting only the trained inventive eye to pluck them forth and marshal them as the slaves of man in new and useful garb.

Brass and bronze are copper alloys with zinc and tin respectively. When the presence of other metals is to be indicated the names are prefixed to the term as tin-brass, aluminum-brass, or manganese-brass.

Time in repairing troubles on the underground system of the city of Philadelphia has been very much reduced by the use of an electric truck. The number of hours in which the underground circuits were out of service was cut down in 1913 about forty per cent as compared with 1912. The cost of operation in 1913 was a little less than for 1912 even with the greater amount of work. The forces employed were twenty as compared with 21 in 1912.

The "safety first" movement has received impetus at Portland, Oregon, by the organization of a commission consisting of Chief of Police Clark, F. C. Burkhalter, general superintendent of the Southern Pacific Company; B. F. Boynton, chief claim agent of the Portland Railway, Light & Power Company; L. R. Alderman, superintendent of schools; Marshall N. Dana and Harry P. Coffin. An exhibit has been arranged and every effort is to be made to educate the public in the necessity for caution.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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The manner of reorganizing the muddled affairs of the Northern Electric Railway Company will react unfavorably on all utility securities. As the Kaiser characterized a sacred understanding "as only a scrap of paper," so those concerns such as the Peoples Water Company and the Northern Electric Railway Company who are now attempting to evade their responsibilities will create the belief that no obligation is binding.

American municipalities have but recently recovered from the bad name resulting from wholesale repudiation of debts. Any financial offering will be a drug on the market if there is any suspicion that the promoters have any future intention of stepping from under at crucial times.

On the other hand an honest assumption of loss and a determined effort to meet underlying bond issues would excite the admiration of the world and do much to bolster up the waning confidence of the investor in public utility securities.

More need not be said, less could not be said. To elaborate further would be unnecessary to those who can understand it—and useless to those who can not.

The public utilities are beginning to recognize that when governmental bodies deny them a fair hearing, it is always possible to go before the people and tell their story freely, fearlessly and frankly.

The latest company to take advantage of this opportunity to present their side of a controversy is the "Key System" which operates a traction service in Alameda county, California.

It seems that this company has outlined an elaborate plan of development intended to adequately care for the increased traffic which is anticipated during the Exposition year. This includes not only the construction of a filled pier, but also new cars and ferry boats, features involving heavy expenditures in these days of financial stringency. Meanwhile the city of Berkeley, one of the municipalities which the company serves, had ordered certain street repaving which would necessitate an expenditure of over one hundred thousand dollars on the part of the traction company. Notwithstanding the fact that the company officials had explained the situation to the city authorities, notice was given that force would be employed to prevent the operation of interurban trains after the first of October, the excuse being that franchises had been granted only for the operation of single cars.

The company met the notice squarely by circulating literature and petitions on their trains and in the homes of commuters. Many patrons protested to the civic authorities against any curtailment in service and as a result what had promised to be a long legal fight was brought to a speedy close by the city consenting to an expenditure of about one-third the orig-

inal demand. This satisfactory outcome was largely due to the company's appeal to public opinion.

It is nearly a hundred years since Emerson wrote "as gas light is found to be the best nocturnal police, so the universe protects itself by pitiless publicity." Like many of the other principles laid down by this master mind the wisdom of applying this fact in every day life is just being recognized.

During the past few months Henry L. Doherty has been conducting a great advertising campaign in Toledo to convince the public of the injustice of a three cent fare. He recognizes that the public is the real umpire and that their good will and confidence is necessary for good utility service.

The value of a favorable public opinion is indicated by the efforts of the several European nations to exonerate themselves in declaring and continuing the present war. Germany is making as strong efforts to cultivate a friendly feeling on the part of the United States. Secrecy is no longer a source of success in either war or business.

The same opportunity for a sympathetic hearing is available to every corporation with a soul, every company which recognizes the public quality of its service. If "big business" has puts its house in order and has a truthful, honest and convincing message, the public is always ready to give a fair hearing. The potency of printer's ink is rigidly dependent upon the merits of the thing advertised.

The most important problem now facing public utility operators is how to improve public relations. If the utility expects an attitude of fairness, frankness and co-operation from the public, it must first assume that attitude toward the public. Confidence can be built only upon the firm foundation of good service, fair treatment and the fullest publicity.

The control of public utilities is now a subject of general interest, particularly in these Western states where the public is being asked to decide the matter at general elections. Without discussing the danger of entrusting such decisions to the average ignorant voter, the fact remains that designing politicians are plotting to keep a hold on the power of making rates in cities. Their plan is not only to rule, but to over-rule the utilities.

In Oregon and Washington, where the state public service commissions have been granted rate-making powers, an effort is being made to take the power away from the commissions. In California the situation is reversed. To insure the enactment of the bill creating the commission, rate-making jurisdiction over utilities in incorporated cities was specifically withheld, except where such cities might vote to surrender those powers. Determined opposition is consequently active to defeat the proposal to extend the commission's jurisdiction over gas and electric utilities in cities.

Utility Home Rule

The strongest argument against state regulation is based upon an appeal to pride in local self-government. It is further contended that rate-making is one of those powers which can be most efficiently exercised by delegating it to some agency directly responsible to those who would be benefitted by having it enforced. While this principle is good political economy for those who might be benefitted, it is equally bad for those who might be harmed. It is predicated upon the thought that regulation is needed only where existing rates are too high. The following quotation from a minority report to the Commonwealth Club of San Francisco is typical of the narrow point-of-view of those favoring municipal control.

It may be that the utility sought to be regulated is one that is operated in one city only, and that it may be in competition with the utility owned by the city. In such a case it seems to me that the city is the best judge of what is a fair and reasonable rate, and at least would not desire to have that question decided by some outside authority.

How fair and reasonable it is for the interested party to determine how much he is to pay for what he buys! It is as natural for the company to want to raise rates as for the citizen to depress them. Some balance must be provided to prevent either of these opposing forces from throwing the whole economic machine out of gear.

The proper equilibrium is being maintained by state commissions who recognize the mutual obligations, that of the company to provide adequate service at reasonable rates, and that of the community to protect the investment against ruinous competition.

A state commission is a continuing body with a steadfast policy and procedure. In this Western territory, where high tension transmission has made hydroelectric power available over wide areas, there are many utilities which supply several large cities. These several cities cannot prescribe as uniform and consistent rates as a commission. Nor can they individually afford the expense of maintaining the high grade technical organization now necessary. Intelligent decision demands expert engineering, accounting and statistical advice. All these facilities are at the command of a state commission at a minimum expense because regularly employed all over the state. A city has no such diversity factor. It can ill afford to maintain a board of public utilities. In fact the money so expended might well be utilized in other necessary public improvements.

Furthermore there have been but comparatively few appeals from the rate decisions of state commissions, whereas the expense of law suits in bolstering up the rulings of city boards is frequently very heavy.

The whole trend of modern economic thought is opposed to political interference with the public service. The politicians are naturally trying to obtain or retain control. So when the question comes to the voter it should be self-evident that both efficiency and justice require that utility rate making powers should be vested in the state commission.

PERSONALS

J. A. Clay, general manager Western Colorado Power Company at Durango, Colo., was a recent visitor at Salt Lake.

P. H. Griffith, chief engineer of the Los Angeles Railway Company, is a recent business visitor in San Francisco.

Elmer Dover, president Western States Gas & Electric Company of Tacoma, Wash., is a recent visitor at San Francisco.

J. T. Reddy of Medford, Ore., who is building an electric railroad in that section of Oregon, arrived in San Francisco last week.

W. T. Kyle, formerly district sales manager for the Duplex Metals Company, has joined the sales force of the Okonite Company at their New York office.

G. A. Sherman, stores manager Western Electric Company, returned to San Francisco from Seattle, where he has been inspecting the warehouses of that company.

W. W. Garthwaite has been named a director in the San Francisco-Oakland Terminal Railways, to take the place of Geo. C. Moore, who recently relinquished control of the road.

F. J. Perrey, formerly salesman Krogh Manufacturing Company, has temporarily re-entered the sales force of the Wagner Electric Manufacturing Company at San Francisco.

W. L. Goodwin, vice-president Pacific States Electric Company, San Francisco, returned recently from a business trip to Los Angeles and throughout the southern part of the State.

F. H. Leggett, Pacific district manager Western Electric Company, and wife, has left for the East where we will visit the factories at Hawthorne, Illinois, and New York. He expects to be gone about three weeks.

Russell Gould has been advanced from superintendent of substations of the Northern Electric Railway, Chico, Cal., to superintendent of power with jurisdiction over the substations, overhead, third-rail and bonding.

H. H. Hatswell, sales engineer, Seattle branch, Charles C. Moore & Company, is visiting the various factories of that company in the East. **Darrah Corbet**, sales engineer of that branch, has recently returned from the same trip.

E. H. LeTourneau, engineer, light and power department, Portland Railway, Light & Power Company, has been appointed secretary of the Northwest Light & Power Association, with offices in the Electric Building, Portland, Oregon.

E. M. Schlessinger, factory superintendent Electric Railway & Manufacturers' Supply Company of San Francisco, recently returned from Fresno, where he inspected the electrical installation of the White Theater and also the Hollenbeck Planing Mills.

H. T. Matthew has resigned as Pacific Coast advertising representative of the McGraw Publishing Company to become general manager of the American Cement Products Company of Los Angeles, manufacturers of concrete lamp standards and poles by the centrifugal process.

Y. Yonezawa, engineer Imperial Japanese department of commerce to America and Europe, will leave San Francisco for the East this week, where he will visit the factories of the Western Electric Company to study telephone and traffic problems and the latest switchboard developments.

W. G. Balph, **W. O. Peale**, detail and supply department, and **O. B. Stroman**, industrial and power department of the Westinghouse Electric and Manufacturing Company, from East Pittsburg, Pa., are in San Francisco, making their annual tour, visiting the various branches of that company.

W. H. P. Hill, formerly district manager Great Western Power Company, Sacramento, has taken the place of **C. C. Craig**, formerly sales manager Northwestern Electric Company of Portland, Ore., who has become the general sales manager for the Coin Machine Manufacturing Company at San Francisco.

MEETING NOTICES.

Seattle Section, A. I. E. E.

The October meeting of the American Institute of Electrical Engineers will be held on Tuesday evening, October 20th, at the Rathskeller, corner Second avenue and Spring street. Dinner will be served at 7 o'clock. The dinner will be followed by reports on the meetings of the national society held at Detroit in June and of the Pacific Coast meeting held in Spokane in September. The program for the year will be outlined.

Jovian Electrical League of Southern California.

About 125 Jovians and a number of guests attended the weekly luncheon of the League, held at Christopher's, on Wednesday, October 7th. The chairman of the day was Deacon Pyle, who had prepared an enjoyable program in the form of a musical treat by Miss Ruby Miller and addresses by Motley H. Flint, chairman of the Los Angeles Convention Committee, on "What 1915 Means to Los Angeles," and Judge Robert L. Hubbard, on "The Big Brother Movement." Mr. Flint's talk was of an optimistic nature in regard to business conditions and the outlook for 1915. He spoke encouragingly about California's exports, remarking that they had increased at the rate of three millions per week. Already thirty-five large conventions have been scheduled to meet in Los Angeles in 1915 and he advocated the use of the city's prayer, "Give us this day our daily stranger." Judge Hubbard, who for a number of years has been associated with Judge Ben Lindsey in Juvenile Court matters, spoke enthusiastically about the aid given to boys, who are going astray, by the 325,000 Elks in this country. This, he added, is an age of humanity, even among business men, as exemplified by the Jovian Order, and what is needed is sympathetic cooperation among men.

Oregon Society of Engineers.

The second luncheon of the Oregon Society of Engineers was held in the Crystal Dining Room of the Benson Hotel, Monday, October 5th, at 12:10 p. m. The chairman of the day was F. I. Fuller, vice-president Portland Railway, Light & Power Company. The speaker was W. D. Wheelright, who spoke upon his experiences in Europe and the various phases of the war.

His talk embraced the Business Aspect of the War, the education features of the various institutions of Europe, the high state of the municipal governments—as regards cleanliness, and the regulation of public utilities, also the public spirit of the citizens as a class. He also traced the history of the various countries at war in Europe and showed plainly the political means of each, closing with a plea for universal peace.

The regular monthly meeting of the Oregon Society of Engineers was held in room A of the Public Library Building, Thursday evening, October 8th at 8 o'clock p. m.

Mr. Chas. E. Warner, consulting engineer, was the speaker of the evening and his subject was "Some Hitherto Monumental Features of the Los Angeles Aqueduct."

Having been chairman of the Los Angeles Aqueduct Investigating Board, Mr. Warner is in possession of much interesting information and data. He pointed out that "wholesale graft" appeared in nearly every department connected with the construction of this project.

The society adopted an official pin and emblem, also authorized the sale of the pins to members. It was arranged

that one Sunday a month would be devoted to trips by those members so desiring, to points of engineering interest. These excursions are to be informal; old clothes will be appropriate and lunch baskets.

Joint Meeting of the A. I. E. E. and the N. E. L. A., Portland, Oregon.

About 150 members and guests of the two societies assembled in Portland at 5:30 p. m. and were taken by automobiles to the Portland Automobile Club, situated on the Sandy River, about 25 miles from Portland. Here they were greeted by some fine musical selections rendered by the "Electric Orchestra" of the Portland Railway, Light & Power Company. Also a fine banquet had been prepared and no time was lost in "getting busy" as every one had an appetite after the fine ride.

Mr. Barker of the General Electric Company acted as chairman and toastmaster. Mr. C. N. McArthur, Republican candidate for Congress, made a short non-political address.

Messrs. West, Moody and Merwin appeared in several "stunts" representing a disgruntled farmer who had bought a motor and received 2-ply juice instead of 3-ply.

Franklin P. Griffith, president of the Portland Railway, Light & Power Company, gave a short address in which he said that he thought that of all the societies which went to make up the activities of the Portland Railway, Light & Power Company, that no societies stood higher in his estimation than the N. E. L. A., the A. I. E. E. and the N. W. P. A. He could see great good for the electrical industry by this intermingling of the men engaged in the electrical business. He also felt that "politics" should not be "tabooed" from these societies, because if politics are to have the "stigma" removed from them, they must have the best thought devoted to them, and that business and politics are really one and the same thing. Also if public officers are to use the "horse sense" that is demanded in private business, it is up to the public to demand same. He also spoke of the need of more development of agricultural enterprises.

The members returned to Portland by automobiles and all were unanimous in their hearty appreciation of the efforts of the entertainment committee for making it possible to have such a pleasant and profitable evening. The enthusiasm aroused will undoubtedly make this year a "banner" year for all the associations.

TRADE NOTES.

A commendable start is being made this year to advertise the week from October 19-24 as "Lighting Week." This can be made a co-operative affair and ties in well with the "Edison Day" celebration.

The Fourth and Fifth Street District Improvement Club, San Francisco, has just placed an order for 95 single light electroliers to be installed on Fourth street from Market to Townsend street. These electroliers are of an original design and will be lighted with nitrogen lamps. The installation was designed by Charles T. Phillips, consulting engineer, San Francisco, who will also have charge of the installation.

NEW CATALOGUES.

Duncan Electric Manufacturing Company of Lafayette, Ind., are distributing an interesting bulletin on Duncan Watt-hour Meters for Switchboard Service. Illustrations and descriptions are given on both a.c. and d.c. meters.

The Edison Business Builder for October from the Edison Lamp Works of General Electric Company, contains a wealth of suggestive and helpful matter for increasing the sale of Mazda lamps, particularly in connection with the celebration of Edison Day on October 21.

The Western Electric Company, 463 West street, New York, are distributing a new mailing folder, entitled "Profit-

able Electrical Merchandise." This catalogs the complete line of dealers' helps which this company offers to the electrical trade to assist it in the sale of washing machines and vacuum cleaners.

INTERNATIONAL ELECTRICAL CONGRESS POSTPONED.

On October 9th the board of directors of the American Institute of Electrical Engineers approved the recommendation of the executive committee of the International Electrical Congress that the Congress be indefinitely postponed because of the disruption of plans by the European war.

Favorable consideration was given to the recommendation that the regular annual Institute convention be held at San Francisco in lieu of the Congress, the date being the only matter of doubt. In order to decide this matter the meetings committee was instructed to canvass the officers of the Pacific Coast Sections as to whether they preferred having the regular annual convention in June or a special meeting in April.

H. A. Lardner, chairman of the committee on Pacific Coast relations for the Congress, has secured accommodations in the municipal auditorium for the week of September 13th, the original date for the Congress, and the week of June 14th, following the annual convention of the National Electric Light Association.

The Institute board has decided that it would not be expedient to accept the courteous suggestion of Chairman Durand that the International Electrical Congress be merged with the International Engineering Congress.

RULING OF SAN FRANCISCO DEPARTMENT OF ELECTRICITY.

James M. Barry, chief of the San Francisco Department of Electricity, has recently issued the following rulings on construction details.

The Department of Electricity will approve the temporary installation of electric motors when installed under the following conditions:

Motor must be protected by approved switch and cutout installed in such a manner that workmen and passers-by cannot come in accidental contact with same. A metal or wooden box for switch and fuses is recommended.

Current carrying wires to motors must be approved rubber insulated double braid wires supported on knobs or installed in conduit and, if on knobs, must be suitably protected at all points where accidental contact is possible by substantial wooden boxing, and, in any case, shall be so protected to a height of 8 ft. 0 in. above the ground. In very hazardous installations, wooden boxing will not be accepted in lieu of conduit.

Motor frame must be grounded. If no good ground is available, a 1½ in. pipe driven into the earth to a depth of 5 feet will be considered a suitable ground. Wire to ground must be equal in size and conductivity to No. 10 B. & S. G. copper.

On temporary motor installations, the Department of Electricity will approve the use of rubber-insulated new code wire with the current carrying values given in Table B, Section 18 of the National Electrical Code. Common return wire on 3-wire two-phase motors shall be figured to carry a current 41 per cent greater than the other two legs.

The above ruling supersedes the ruling of the department on temporary motor installations under date of January 13, 1914, and is revocable at any time on due notice.

On exposed ends of conduits back of switchboards where it is necessary to cable wires together, in order to do a workmanlike job, approved porcelain bushed iron bushings will be accepted in lieu of condulets. Hereafter, plain iron bushings will not be accepted on exposed ends of conduit back of switchboards.



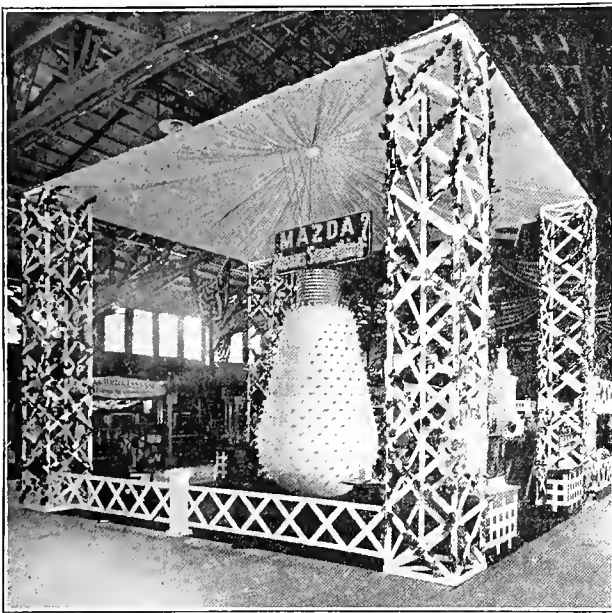
INDUSTRIAL



A MAZDA JOURNEY.

Last week a number of live wires in the region of San Francisco Bay, where the electrical variety thrive to perfection, were personally conducted on a journey through Alameda county in order to find out what Mazda means. H. H. Cudmore, director of the Mazda Bureau of the General Electric Company, was the personal conductor.

Like all properly regulated journeys the trip was not taken until after the needs of the inner man had been fully cared for by a sumptuous lunch at the Hotel Oakland. If the needs of the lamp consumer are as well anticipated as were those of the luncheon guests, Mazda is certainly synonymous



Mazda Exhibit.

with service. Nor did Mr. Cudmore serve ice with his enthusiasm in telling what had been accomplished by the "Mazda Bees" during the past month in letting the public know that "Mazda means something."

Waiting automobiles whisked the party in a brief circuit of a few of the forty-five electrical stores in Oakland which carried window displays of the slogan and service. This business joy ride to give the "up-and-down" over Mazda window displays, bill-boards and newspaper advertisements terminated at the Alameda County Exhibition and Carnival at Idora Park.

Here the Mazda exhibit, as shown herewith, was given the "once-over" and opportunity afforded to visit other electrical displays at the fair. The Mazda exhibit, however, was the central attraction, the observed of all observers, the cynosure of all eyes.

Those who were fortunate enough to be invited in this little journey of observation of Mazda co-operation with distributors were as follows:

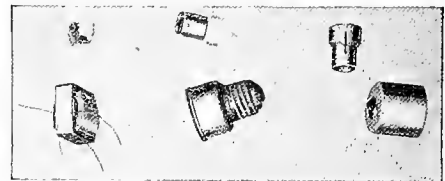
W. W. Goodwin, Pacific States Electric Co.
 Col. H. V. Carter, Pacific States Electric Co.
 D. E. Harris, Pacific States Electric Co.
 W. W. Briggs, Great Western Power Co.
 F. H. Woodward, Great Western Power Co.
 M. Burton, Westinghouse Lamp Co.
 C. Heise, Westinghouse Elect. & Mfg. Co.
 R. D. Holabird, Holabird-Reynolds Co.
 C. C. Hillis, Electric Appliance Co.
 F. J. Cram, Electric Appliance Co.
 W. L. Berry, Western Electric Co.
 F. H. Leggett, Western Electric Co.
 M. A. Bryce, Sterling Division National Lamp Works of General Electric Co., Mission St.

A. H. Coates, Colonial Agency Co.
 Chas. Wiggins, Dunham, Carrigan & Hayden.
 C. I. McColgan, Columbia Division National Lamp Works of General Electric Co.
 E. B. Strong, Journal of Electricity, Power and Gas.
 A. H. Halloran, Journal of Electricity, Power and Gas.
 F. D. Fagan, General Electric Co.
 P. A. Vandegrift, Oakland Mazda Lamp Division National Lamp Works of General Electric Co.
 Albert H. Elliott, attorney for Jobbers' Association.
 T. E. Bibbins, General Electric Co.
 Mr. Welling, Federal Sign System (Electric).
 Andrew Carrigan, Dunham, Carrigan & Hayden Co.
 Dr. T. A. Addison, General Electric Co.
 Mr. Landry, Dunham, Carrigan & Hayden.
 W. F. Boardman, W. F. Boardman Co.
 Mr. Eckert, W. F. Boardman Co.
 John Britton, Pacific Gas & Electric Co.
 Geo. C. Holberton, Pacific Gas & Electric Co.
 Mr. Furness, Pacific Gas & Electric Co.
 F. A. Leach, Pacific Gas & Electric Co.
 Frank Fowden, Brooks, Follis Elec. Co.

MINIATURE TRANSFORMER FOR ALL-NIGHT LAMPS.

The inability to turn down an electric lamp has been a great inconvenience to those who desire a low burning lamp for all night service. The demand for an electric light which could be burned all night without too much light and too great a cost for current has created several types of all night electric lamps of which the Nite Lite transformer lamp, produced by the General Electric Company, is the latest.

The device consists of a miniature transformer contained in a polished brass shell, and a miniature Mazda lamp. It operates on any alternating current supply circuit ranging



Miniature Transformer for All-Night Lamps.

in voltage from one hundred to one hundred and twenty-five, and in frequency from fifty to one hundred and forty cycles. It is installed by simply screwing it into the standard lamp socket in place of the usual incandescent lamp.

The transformer, although miniature in design, is constructed with liberally insulated primary and secondary coils, and with a core built of the highest grade of transformer steel punchings. Its function is to transform the normal supply voltage to about six or seven volts before it is supplied to the lamp. The receptacle for the lamp is designed to fit a rear and speedometer Mazda automobile lamp, 2 c.p., 6 and 7 volts, 1.25 w.p.c., G-6 bulb with bayonet base.

The cost of operating this device continually is very little. At the average cost of electricity, a Nite Lite transformer will burn for ten hours at a total cost of less than four-tenths of a cent. The device is especially adapted to the illumination of door numbers, sick rooms, nurseries, bath rooms, closets, etc.

PUBLICATIONS RECEIVED.

Factors Governing the Combustion of Coal in Boiler Furnaces is the subject of a preliminary report from the U. S. Bureau of Mines by J. K. Clement and J. C. W. Frazer.



NEWS NOTES



FINANCIAL.

SAN FRANCISCO, CAL.—The Municipal Railway bond fund is insufficient for the construction of the new lines for which it was voted, according to a report by Leonard Leavy, bookkeeper of the Public Works Board. The deficit is attributed to the extra cost of the cable system for the Church street hill, which the supervisors lately ordered. The bonds of the issue of \$3,500,000 that have been sold amount to \$2,642,500. They brought a premium of \$23,658. Whether the remaining \$837,000 can be sold now is considered doubtful because of market conditions. For work already undertaken \$1,915,567 has been expended. For final payments on contracts and finishing the present work, \$718,226 is required. For new work, the city engineer's estimate is \$1,020,240, making a total of \$3,654,033. If the remaining bonds are sold the available cash will total \$3,523,658, leaving a deficit of \$130,374. This may be reduced by \$39,005 if the following refunds are received: From the Ocean Shore Railroad, \$34,676; from the Western Pacific \$1467; from the street lighting fund, on account of Van Ness avenue lights, \$2861. The city engineer's estimate for new work includes these items: California street line, \$127,500; reconstruction of Union street line, \$49,000; Potrero car barn, \$211,325; work cars and tower wagons, \$10,000; Church street line, with cable, \$433,000; machine shop equipment, \$6500; plans and inspection, \$54,000 additional; freight on cars, etc., \$44,065, in addition to \$137,000 already appropriated; track specials, \$22,486; trolley poles, \$9883; completion of Van Ness and Chestnut street construction, \$8861.

ILLUMINATION.

PORT ANGELES, WASH.—A number of light extensions will soon be made.

LAGUNA BEACH, CAL.—Several parties are considering putting in a local electric light plant at once.

BILLINGS, MONT.—W. B. Snyder, general manager, states that the Billings Gas Company will erect a 200,000 cu. ft. capacity holder in the spring.

VICTOR, IDAHO.—A special election has been called for October 24 to vote on the question of \$3500 bonds for the construction of an electrical distribution plant.

PASADENA, CAL.—The city trustees of South Pasadena have advertised for bids for lighting Fair Oaks avenue, to Alhambra road, where it joins the county boulevard.

PASADENA, CAL.—H. C. Deming is interviewing property owners fronting on South Marengo avenue relative to the installation of an ornamental street lighting system.

GLENDALE, CAL.—The Pacific Light & Power Company has bid on ornamental light posts and current for lighting Brand boulevard. The bid calls for 81 metal posts with appliances.

PORTLAND, ORE.—Permission has been granted by the county commissioners to property owners and business men for a system of bracket lights on Fourth street from Yamhill to Burnside.

LOS ANGELES, CAL.—The board of supervisors of Los Angeles county, Cal., will receive bids until October 19th for furnishing electricity and maintaining lights in the Burleigh lighting district.

ALAMEDA, CAL.—The city council has agreed to reduce the commercial lighting and power rates from 7c to 5c per 1000 kw. respectively to 5c and 3c. The council also decided to extend the lines of the local electric plant to Bay Farm Island.

PORTLAND, ORE.—Property owners and business men on Fourth street have been granted permission by the city commission to install a system of street bracket lights. As soon as plans can be made work will begin.

WINNEMUCCA, NEV.—The possibility of gas service in Winnemucca is indicated by a petition to the county commissioners to grant a franchise for gas mains to W. J. Compton and Frank L. Reber for a 20-year period.

ANAHEIM, CAL.—Preparations are being made for the installation of an ornamental lighting system in Anaheim. Sample cluster lights will be installed at the corner of Center and Los Angeles streets as soon as possible, and if satisfactory, additional lights will be installed.

SPOKANE, WASH.—J. D. Isaacs, Jr., resident engineer in charge of terminal work for the O-W. R. & N. and the C. M. & St. P., has presented details of plans for lighting street areas under the elevated structures of the railroad companies to Commissioner McBroom.

WOODLAND, CAL.—Plans are being formulated by the officials of the Pacific Gas & Electric Company to improve the gas service in Woodland. The project is to either construct a new plant altogether or lay a pipe line from Sacramento and discontinue the making of gas here. Which ever plan is put into effect it necessitates an outlay of between \$40,000 and \$50,000.

REDLANDS, CAL.—A contract has been signed by the city board of trustees with the Edison company for street lighting for 5 years. There had been some talk of a municipal plant, but that plan was laid over in view of the contract submitted by the Edison Company. Under the contract, all incandescent street lighting will be Mazda lamps of 32 candle power, replacing the present 16 candle power lamp.

TRANSMISSION.

NOGALES, ARIZ.—The International Gas Company is constructing a modern electric light and power plant here. Power will be furnished in adjacent territory.

EXETER, CAL.—The Tulare Power Company has been granted permission to erect an 11,000 volt distribution line from the northwest corner of Chestnut and F streets north on F street.

LOMPOC, CAL.—The city trustees have granted a permit to the Kieselguhr Company to build a power line from their plant to the city limits to connect with the line of the Midland Counties Public Service Corporation.

LEWISTON, IDAHO.—R. C. Dahlheim and associates will ask for franchises for an electric railway in Clarkston and Lewiston. Option is held on the property of the Lewiston Terminal Company calling for the completion of the road before 1916.

POCATELLO, IDAHO.—As a result of a recent storm, when lightning wrecked the substation of the Southern Idaho Water Power Company at Ross Fork, considerable improvement will have to be done at that point. Two transformers were burned out, and the building was burned down.

FALLON, NEV.—The Nevada Valleys Power Company, successful bidder for the power output of the Lahontan dam of the Government Irrigation Project, is purchasing supplies and preparing to start work on a power line 82 miles long, from Lahontan to Hazen, Hazen to Lovelock and Lovelock to Orlena and Rochester. A 60,000 volt line will transmit power for use in irrigation by pumping and for use in the new mills being constructed at Rochester. The company has filed a cash bond of \$25,000 with the government.

TRANSPORTATION.

SAN FRANCISCO, CAL.—The supervisors' finance committee has agreed to accept from the United Railroads \$44,379, which the company figured was the franchise percentage due the city for the year 1913.

OAKLAND, CAL.—Petitions signed by 7500 persons requesting that permission be given for the continuation of Key Route trains from Twelfth and Poplar streets along Twelfth street to Broadway, have been filed with the city council.

BENICIA, CAL.—The city trustees have granted to A. D. Bowen an electric railroad franchise over the streets of the city to the city limits on the Vallejo side. The projected line will connect Benicia and Vallejo. A line to Winters is also proposed.

SAN FRANCISCO, CAL.—The city attorney has advised the board of public works that the United Railroads' franchise on O'Farrell street allows either a single or double track, and the company can be compelled to pave only its single track roadway. This it has done.

SACRAMENTO, CAL.—The Pacific Gas & Electric Company has been granted until May, 1915, to complete the extension of the Riverside road line by the city commission. Manager C. W. McKillip said his company had been unable to get the data on the grade owing to the building of the levee in that district until the present and wanted an extension of time until after the rainy season.

BERKELEY, CAL.—The threatened cessation of operation of Key Route trains in Berkeley was bridged over at a conference in the city hall of Berkeley between Mayor Charles D. Heywood, members of the city council and President G. K. Weeks, Director W. I. Brobeck and General Manager W. R. Alberger of the San Francisco-Oakland Terminal Railways. The latter officials agreed to make immediate street improvements at an expense of \$37,000 and devote the first money earned by the traction system to permanent improvements in Berkeley.

TELEPHONE AND TELEGRAPH.

DINUBA, CAL.—At a recent session of the city board of trustees, arrangements were made for the purchase and installation of a new fire alarm system.

STOCKTON, CAL.—The city council has passed an ordinance prohibiting the Pacific Telephone & Telegraph Company from exacting a \$5 deposit from prospective subscribers as a prerequisite to the installation of a phone.

NELSON, B. C.—Work will start at once on the construction of the dominion government telephone lines. W. H. Stevens, Kamloops, B. C., superintendent of the dominion telephone and telegraph construction in British Columbia.

RED BLUFF, CAL.—At a meeting of the stockholders of the Tehama County Telephone Company the proposition of selling to a newly organized company was discussed. It appears that a new company desires to purchase the plants of the independent companies and Pacific Telephone & Telegraph Company in Tehama and Colusa counties.

ALAMEDA, CAL.—The city council has agreed to give the Pacific States Telephone & Telegraph Company a franchise for 41 years, in exchange for 2 per cent of the gross receipts, 35 free telephones, the use of the company's poles for municipal electric wires, the amount of the cost of the telephones since the former franchise expired and also 2 per cent of the gross receipts since the old franchise expired.

SAN FRANCISCO, CAL.—Jesse W. Lilienthal of the United Railroads and John A. Britton of the Pacific Gas & Electric Company spoke at the convention of the American Railway Association. The three advocated the gaining of the public confidence by public utilities companies as the surest

way to success. 'The public confidence can only be gained,' said Britton, in part, "by the kind of treatment that a reasonable person demands of another in the ordinary walks of life."

WATERWORKS.

SUNNYVALE, CAL.—The city clerk has been instructed to advertise for bids for a water works plant.

RED BLUFF, CAL.—A petition has been received asking that the town provide for a new water system at a cost of \$85,000.

LEWISTON, IDAHO.—Contractors Charles Hahn, Crane & Company have been awarded the contract for supplies for the water department.

POCATELLO, IDAHO.—The Short Line is preparing to improve its water system, or that portion of it leading from the city creek. The old wooden pipes will be replaced with iron ones, some of which are already on the ground.

EL PASO, TEXAS.—The city council has awarded the contract to the Fulton Iron Works of St. Louis, to install additional machinery at the city water plant. This firm will furnish an oil engine, pump and air compressor. The cost will be about \$44,700.

SPOKANE, WASH.—The raising and diversion of three of the city's big water mains, which now cross Division and Sprague streets, and the protection of two others branching south from Division is one of the tasks connected with the grade separation work.

EL CENTRO, CAL.—H. W. Blaisdell of Blaisdell Filtration Company of Los Angeles, is conferring with the city trustees relative to the installation of a filtration plant here. Blaisdell estimates the cost at about \$25,000 to remodel the present city plant and install a new filtration system to furnish 2,000,000 gallons daily.

SAN FRANCISCO, CAL.—By a vote of 13 to 5 the supervisors have decided to submit the proposal to buy the Spring Valley Water Company's properties at \$34,500,000 to a vote of the people. The report of the advisory water committee, of which Chief Justice Sullivan is chairman, was indorsed in its entirety, and the city attorney was directed to draw up the proper resolution calling an election of the people to vote upon the question.

LOS ANGELES, CAL.—Chief Engineer Mulholland has presented to the Public Service Commission the map of the proposed Chatsworth reservoir, which it is intended to construct so as to conserve the full supply of the aqueduct and provide a constant source of water for the power project. There are only three land holders to be dealt with in securing the land desired, and Mr. Mulholland stated that he has assurances that the rights of way can be secured for almost nothing. The board formally approved his report and authorized him to proceed to acquire the necessary lands and to advance the plans for the project. About nine miles of rights of way will have to be secured.

SACRAMENTO, CAL.—An expenditure of \$5,941,300 is being undertaken by seven companies to divert water from the streams of California, according to the report by the State Water Commission. The report includes matters brought before the commission between March 23, 1912, and April 1, 1914. A total of 38 applications asking permission to divert State waters, were presented, of which 21 were rejected and 11 granted. Four were later revoked because of failure either to comply with the provisions or because of request from the companies. Following is a list of the pending undertakings: Murray & Fletcher, Boulder Creek, \$75,000, cost of works; Yolo Water & Power Company, Clear Lake and Cache Creek, \$5,185,000; Salve Olsen, North Fork of Feather, \$7500; J. F. Thompson, Volcano Canyon, \$4000; C. E. Loose, East Walker, \$422,302; Birchville Mining Company, Weaver Lake, \$30,000; R. G. Gillespie, North Yuba River, \$18,500.

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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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SAN FRANCISCO, OCTOBER 24, 1914

PER COPY, 25 CENTS

STANDARDS FOR GAS SERVICE IN THE WEST.

BY R. S. McBRIDE.

STREET LIGHTING YESTERDAY AND TODAY.

BY RALPH E. CUNNINGHAM.

STANDARDS IN SAN DIEGO.

BY L. M. KLAUBER.

A RESUME AND COMPARISON OF RATE THEORIES.

BY STACY HAMILTON.

LOS ANGELES AQUEDUCT MISTAKES.

BY CHARLES E. WARNER.

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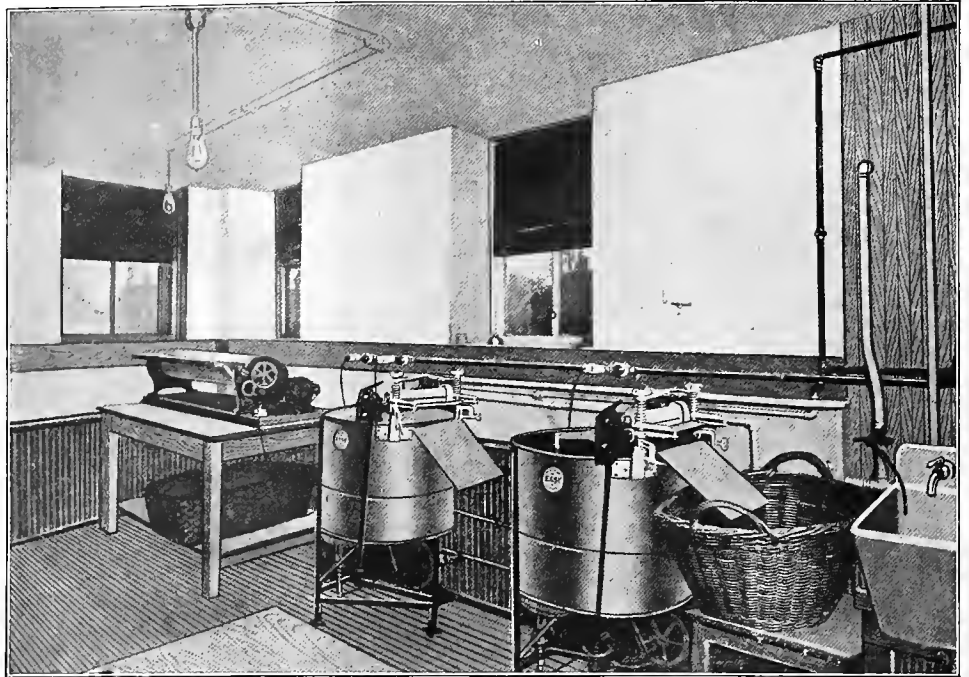
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Business stimulators you have been searching for—articles that should be in every household and nice profit producers for you.

“Easy” Washing Machines



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for laundry use either in the home or for commercial purposes.

Cleaning is done by vacuum and suction process and the most delicate fabrics may be washed without the slightest fear of soiling or damage.

Will not rust or corrode, and have no wooden parts to rot or warp.

Made of solid copper throughout.

The G. E. motor and working mechanism is mounted underneath the copper tub out of harm's way.

The entire machine rests on rust-proof casters and so that it can be conveniently moved to any location.

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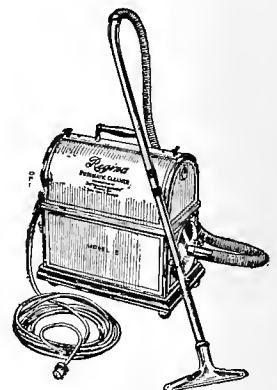
Equipped with G. E. motor for either direct or alternating current.

Notice the position of the dust bag—entirely encased and placed between the intake and the motor, being easily removed for cleaning and doing away with the possibility of dust or dirt getting into the working parts and causing trouble.

Mounted on rubber-tired wheels and may be used either as a sweeper or with a hose and special cleaning tools when desired. Fully guaranteed.



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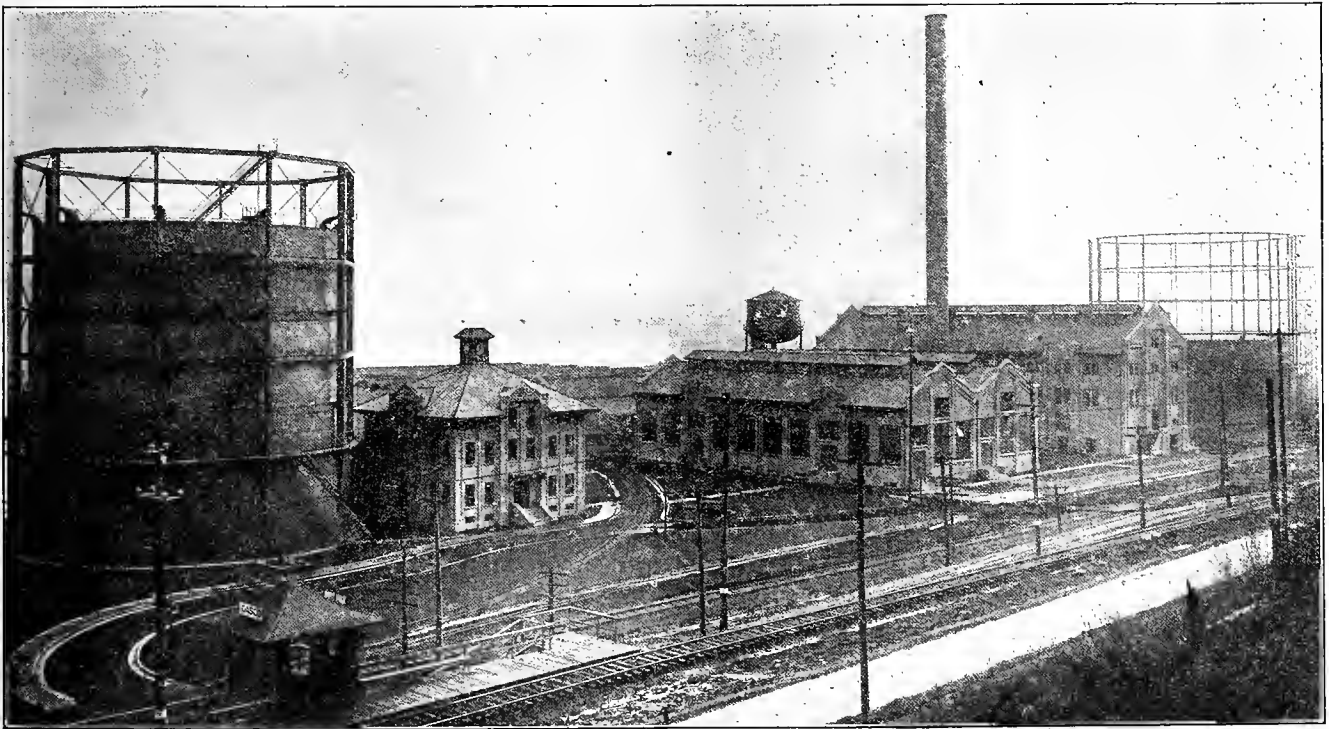
STANDARDS FOR GAS SERVICE IN THE WEST

BY R. S. McBRIDE.

(After a critical consideration of the several technical factors involved in setting standards for gas service, the author draws valuable conclusion as to points of difference between Eastern and Western practice and standards, particularly as regards heating value. The next installment will be concerned with the discussion of oil-gas conditions. Mr. McBride is engineer with the U. S. Bureau of Standards and this article is published with the permission of the Director.—The Editor.)

During the early part of 1913, the Bureau of Standards was requested by the Railroad Commission of Oregon, to make a preliminary report to the commission commenting upon certain proposed rules for

of American gas making conditions, which has been a necessary supplement to work done by it on standards for gas quality and gas service. Second, the collection and study of such data as have an imme-



Gas Plant of Portland Gas & Coke Company.

gas service in that state. From time to time during the year the Bureau gave considerable attention to the question and finally during January and February of 1914 a representative of the Bureau visited the West to make a further study of gas making conditions.

This work had a two-fold object: First, gathering from the western part of the United States information of value to the Bureau in its general study

diating bearing upon the question of the proper standards for gas made and sold in the state of Oregon. The material which was collected by conferences and correspondence has been utilized in the preparation of a report to the Railroad Commission, thus carrying out the second named object of the work. This material has also been utilized in the preparation of supplementary sections for Circular No. 32, which is now being revised for a third edition. Some of the

information is of such general interest that it seems desirable at this time to give it wider publicity in the form of the present article.

Scope of Gas Service Rules.

Rules fixing standards for gas service in general give consideration to five principal technical subjects, namely, candlepower, heating value, purity and pressure of gas, and the testing of gas meters. In addition to these five subjects certain provisions are, of course, made for general regulatory matters, such as the requirement of deposits from customers, bill forms, interruptions of service, investigation of complaints made by customers, etc. It is unnecessary in the present article, however, to discuss any of the general questions, since the information gathered by the Bureau has a bearing only upon the principal technical regulations above referred to.

Candlepower of Gas.

The rules which were proposed by the Railroad Commission of Oregon made no provision for a requirement of gas candlepower. In this respect the Commission was following the practice of other state commissions, and a very cursory consideration of western conditions has indicated that there is little, if any, need to consider a requirement of gas candlepower in the states of the far western part of this country. This is particularly true of this section, since the use of gas for lighting is limited; and such use as is made of gas for this purpose is made in mantle burners, so that the customers of this part of the country, practically speaking, are not interested in what the candlepower of the gas is. The general discussion which has been given in publications of the Bureau of Standards on the subject of the advantage and disadvantage of candlepower specifications and the suggestions as to conditions under which such requirement may be needed make it unnecessary to take up this question further in this paper.

Purity of Gas.

The requirements adopted, prescribing limits for various impurities in gas, commonly take account of the hydrogen sulphide, the total sulphur, and the ammonia content of the gas. In the consideration of standards for oil gas and for the other kinds of gas made in the states of California, Oregon and Washington no unusual conditions were found which would affect these customary standards for gas purity.

Hydrogen Sulphide.—The elimination of hydrogen sulphide from gas, whether it be coal gas, water gas, or oil gas, is not difficult. It is only a question in any locality as to how much hydrogen sulphide must be cared for; and it is fortunate that in the western part of the country no unusually large amount of this impurity is found in the raw gas.

Ammonia.—Because of the high temperatures which are maintained in the generators during the manufacture of water gas or oil gas practically no ammonia is found in gas made by either of these processes. For plants using these processes an ammonia limit is not necessary. In coal gas manufacture a considerable amount of ammonia is always produced and this should be reduced within reasonable limits before the gas is distributed.

Under the climatic conditions of the western states, no difficulty should be met in keeping the ammonia content of coal gas well below the ordinary limits of 5 to 10 grains per 100 cu. ft. of gas. In almost every case where coal gas is made an ample water supply of fairly low temperature at all times would be available, and this condition greatly facilitates operation in conforming to such limits.

Total Sulphur.—The amount of sulphur occurring as total sulphur in the finished gas is usually largely dependent upon the sulphur content of the fuel from which the gas is made. The severity of any limit upon total sulphur is therefore largely determined by the character of the gas-making fuels available in the locality. The gas coal and the coke used in the coal-gas and water-gas plants of the west, are usually high and exceedingly variable in sulphur content, not only in comparing the coal from different mines, but also the coal from a single mine at different times. Fortunately, however, from the standpoint of the gas maker, the sulphur seems to be present in these coals in such a condition that the greater part of it is retained in the coke and eventually in the ash. Gas made from this coal, or from the coke which it gives, is therefore not usually high in "fixed" sulphur. As a generalization it is probably safe to say that little difficulty will be met by the western coal-gas or water-gas maker in meeting a limit of 25 or 30 grains of sulphur per 100 cu. ft. of gas.

The amount of sulphur in the crude oil or the oil distillates used in the manufacture of oil gas or for carburetting water gas is variable. However, many of the gas companies have found no difficulty in securing oil of less than 1 per cent sulphur content; this quality permits manufacture of an oil gas containing less than 25 grains of total sulphur and when used in carburetting water gas gives no difficulty because of its sulphur content. In some places greater difficulty has been met in the past in securing oil as satisfactory in this respect; and as a result the Portland Gas & Coke Company developed the re-heating process for the reduction of the fixed sulphur content of gas. However, during the past year or more, the company has been so successful in securing oil of low sulphur content that it does not find it necessary to utilize this special process. All of the information secured by the Bureau would indicate that a supply of oil of suitable character can regularly be obtained and no difficulty need be anticipated in the operation to conform to the specification similar to those commonly enforced, for example, 25 to 30 grains of total sulphur per 100 cu. ft. of gas. There is some indication that the difficulty of meeting such requirement will grow less rather than greater, since the oil distillates, which are being more and more employed for gas making, are in general of lower sulphur content than the crude oil itself.

Gas Pressure.

As compared with the eastern part of the United States, western gas distributing conditions differ in two particulars. In the first place the cities, and consequently the sales of gas, are increasing much more rapidly in the west. This has made it more difficult to maintain at all times satisfactory gas pressure without the use of some form of high pressure dis-

tribution. The very common use of the high pressure systems is the second characteristic of the west.

The use of a high distribution pressure for gas has, however, in no way complicated the matter of fixing specifications, since the high pressure distributing systems are supplemented either by district or consumers' governors, which permit delivery to the customer at pressures comparable with those used in the eastern part of the country. When this system is used the important question is for what pressure should the regulators be set.

In general no difficulty will be found in the western states in maintaining pressures above a 2 in. minimum and in many cases it would be possible, although not usually necessary, to maintain a minimum of 4 in. at the outlet of the service pipe to any consumer. In those places, which are in the majority, where a high pressure system with district or consumers regulators is employed, very little variation in pressure at any point need be allowed. Usually no more than 2 in. variations need occur on any day at any service outlet.

Some engineers have objected to the placing of a maximum limit upon gas pressure and under certain conditions such limit may not be desirable; but for domestic supply a pressure higher than 6 or 8 in. is usually not desirable since with the higher pressure on the ordinary forms of gas consuming appliances the gas is not so economically utilized as when the pressure is lower, say 4 to 6 inches. There is little ground for objection to a maximum limit of 6 or 8 or 10 in. at the consumers service outlet, if it be provided that a higher pressure can be maintained in the mains or in the customers premises whenever the customer needs such pressure for use with high pressure appliances.

The Bureau has received no information which would lead it to believe that the discussion in its Circular No. 32 on the question of gas pressure limits is not applicable to western as well as to eastern conditions. The rules which it proposes might therefore be considered applicable in general for the western states.

Testing of Gas Meters.

The Bureau has had no opportunity to determine whether a gas meter used for the measurement of oil gas operates differently than if used either for coal gas or water gas. It has been found that a considerable number of the western companies make a practice of frequent removal of meters for testing. Several companies remove all meters after 3 years, in order to test and if necessary overhaul. There is no reason to believe, however, that the period between routine, or "periodic" testing, need be different when oil gas is supplied than when coal gas or water gas is distributed. Certainly the general conclusion reached by the Bureau as to the practicable limits of accuracy for original setting and for meters when removed from service are equally applicable in the western part of the country. The discussion on meter testing requirements of Circular No. 32 needs little, if any modification for application in that district.

Heating Value.

The heating value of a gas is the best measure of its quality for most of the uses to which commercial gas supplies are put. If used for cooking, room heat-

ing, or other purposes where the heat developed is the determining factor, it is of primary importance. The usefulness for mantle lighting and for development of power in a gas engine is nearly proportional to the heating value. The heating value is, however, not a measure of the usefulness for open-flame lighting; but this is not an important consideration in the western states, since very little gas is used for lighting and practically none for lighting in open-flame burners.

The most desirable condition is therefore, that which will permit the gas company to deliver to the customer the largest amount of useful heat for one dollar of cost to the customer. This is recognized as the ideal condition, but the general principle thus enunciated has been variously applied, in some cases apparently without due consideration of the real significance of all the factors entering.

A customer is primarily interested in the quantity of heat which he will obtain on the average, but irregularities in quality are objectionable.

The variation which must be allowed in the case of oil gas is not materially different than in the case of coal gas or water gas. The discussion in Circular No. 32 of the Bureau of Standards of the subject of "Monthly Average and Minimum Values" is therefore applicable to gas made by any of these processes.

After consideration of western conditions it was evident that the numerical value which should be prescribed as the required monthly average heating value, is the only one to which particular attention need be directed. The other phases of the subject of heating value standards have already been sufficiently discussed in the publications of the Bureau.

In most cases the selection of heating value requirements has been made either to correspond with the figure required elsewhere or to the figure representing the quality delivered by the companies to be regulated previous to the time of the regulation. Neither of these two methods taken alone is a proper one. The first, because rules which are applicable under one condition may not be applicable under another; and the second, because there is no means of knowing without other investigations whether the previous practice of a company is the best, either for it or for the customers concerned.

The correct basis for a heating value standard, namely, the delivery of the most heat to the customer for one dollar, has sometimes apparently been misapplied. For example, in one case a decrease in the heating value standard was recommended in order to meet certain economic conditions, but it was not made clear that either greater economies would result or that the company's customers would benefit by this lower heating value. The companies would thus earn a larger rate of return; but it was not shown that this was necessary.

Another misapplication of the principle has been found in the case of those companies which argue that the best condition is one which will permit manufacture at the least net holder cost per heat unit. However, it is the total cost, not the net holder cost, of the heat unit which should be a minimum.

Still another way in which the fundamental principle has been modified is on the basis of "conservation of materials." Those using this argument state that

the heating value which enables one to get the largest number of heat units from each pound of coal or gallon of oil is the best. This argument is correct only in those cases in which the main principle is not violated by its application.

The correct application of the principle requires a consideration, not only of the cost of manufacture, which is directly affected by changes in quality, but also a consideration of the changes in sales with changes in heating value of the gas and their effect on all operating costs. Moreover, it is necessary to consider what changes in fixed charges, both per thousand and in the aggregate, will result from changing quality. In other words, it is necessary first to determine approximately for each of several qualities of gas what would be the proper price to charge the customer in order that all operating expenses be paid, proper allowance made for depreciation, and a proper return upon the investment assured. It is then easy to determine which of the several qualities of gas will give to the customer the most heat for each dollar paid.

The field investigations made by the Bureau were not confined to a study of Oregon conditions, although each of the eleven gas companies of this state were consulted by the Bureau, either directly or indirectly. The principle cities of Washington and California were also visited and conferences were held with many gas engineers. In addition to the information collected by personal conferences, the Bureau has obtained some information by correspondence, particularly that contained in the replies to a circular letter which included questions with reference to oil-gas manufacture only.

In taking up the question of what numerical value should be fixed for the monthly average total heating value in any particular case, the Bureau believes it desirable to consider the following questions in the order in which they are named:

1. What manufacturing limitations are there which control the quality of gas which can be made with the process under consideration?
2. What is the relative cost of manufacture for the different qualities of gas with the process under consideration?
3. What is the relative usefulness of the gas when of different qualities?
4. How will the total sales be affected by any changes in the quality of the gas?
5. What is the proper selling price for gas of the different qualities, and which quality permits the delivery of the most heat to the customer for each dollar to be paid by him?
6. What other factors enter to affect the choice of a heating value standard?

The question as to the quality of solid fuel obtainable in any locality is of minor importance in fixing a standard for carburetted water gas, since it is always possible to make this gas of the quality desired up to a limit probably somewhat above 700 B.t.u. per cu. ft. Any manufacturing limitations can therefore be practically ignored when considering water gas; and the question becomes then largely one of relative cost of manufacture of different qualities of gas.

The Bureau has found no reason to believe that water-gas making conditions are materially different

in the West than in the East as far as relative costs of gas of different qualities is concerned. The following generalization of Circular No. 32 (page 29 of second edition) is therefore suggested as being applicable throughout the country.

It appears to the Bureau that unless by-products or un-enriched coal gas is to be delivered a requirement of 600 B.t.u. is reasonable and in general more economical than a lower value (except when on local cubic foot basis in a city of low barometric pressure); and although this generalization will not hold in every case, it appears reasonable that when a company desires to distribute gas of less than 600 B.t.u. the burden of proof should rest upon such company to show that the local conditions are such as to permit better service with a lower heating value. If the number of heat units to be delivered for a dollar is greater with less than 600 B.t.u., then such lower value may be allowed; certain conditions where this may be the case have already been made clear.

There is no question but what water gas of 600 B.t.u. can be distributed under the climatic conditions of the Western States with small distribution losses and of satisfactory uniformity of quality when regular calorimetric tests are made. Such gas would give good satisfaction to the customer, since it is well suited to the ordinary domestic and industrial appliances, it permits efficient utilization, and with it satisfactory speed can be obtained in cooking, heating, etc.

In the selection of a heating value standard for coal gas, the first factor which must be considered, is the character of the coal from which the gas is to be made. The plants making coal gas in Washington and Oregon are, and will no doubt continue to be, supplied with coal from the fields in the south-central portion of Washington, particularly from the South Prairie or the Roslyn districts. The Bureau has information as to the results which have been obtained in Seattle, Tacoma and Spokane, as well as the results which have been obtained by the Portland Railway, Light and Power Company, at Salem, Oregon, and the Pacific Light and Power Company, at its various coal-gas plants. All of this information would indicate that there is little difficulty with the better class of Washington gas coal in obtaining satisfactory yields of a gas of 600 B.t.u. cu. ft. Indeed, from the standpoint of yield of heat in the gas, these Western coals appear to be more satisfactory than many of the commonly used Eastern gas coals. However, their poor coking quality is a disadvantage. At least from the standpoint of the manufacturing limitations, a requirement of 600 B.t.u. is not unreasonable for coal gas made in this district.

The experience of those companies which have been operating with calorimetric control would indicate that coal gas can be made with a heating value of 600 B.t.u. on the average with no serious economic difficulty. The Washington companies had been operating under such requirement for a number of years and the Bureau has not received any information to indicate that this requirement has proven to be a hardship upon the companies. Since this gas is very stable under the climatic conditions of these states, and since the 600 B.t.u. coal gas is highly satisfactory to the customer, a standard such as is in force in Washington and has recently been adopted by the Railroad Commission of Oregon, will probably be satisfactory for any coal-gas plants of this section.

[To be continued.]



LIGHTING METHODS



STREET LIGHTING—YESTERDAY AND TODAY.

BY RALPH E. CUNNINGHAM.

(This article briefly traces the history of street lighting from the earliest crude methods to the latest developments. The author is superintendent of distribution for the Southern California Edison Company at Los Angeles.—The Editor.)



R. E. Cunningham.

"Yesterday" seems entirely out of place, because as time is reckoned there was no street lighting yesterday; for the shadows have hardly disappeared which were made by the flame of the old pine knot, and the wildest dreams of the genius of yesterday did not include the present day principles involved in street lighting. The history of street lighting is the history of human progress during the past century. By leaps and bounds, springing as it were from nothing, until all the known forces of nature are contributing to the desired end. Light has always been the symbol of life; we learn that a place was found for it in all of the ancient forms of religious worship and today light is the medium by which men pay their homage not only to the "great white way," but in the pursuit of useful industries: Manufacturing and all classes of

eral public were suspicious and did not appreciate the wonderful improvement. The Germans seem to have been the first to make use of it. The following arguments against the illumination of streets by means of gas are reprinted from the "Koelnische Zeitung," March 28, 1816:

The illumination of streets at night by means of gas is objectionable for the following reasons:

1—From the theological standpoint. Artificial illumination is an attempt to interfere with the divine plan of the world, which has pre-ordained darkness during night time.

2—From a judicial standpoint. Those people who do not want gaslight ought not to be compelled to pay for its use.

3—From the medical standpoint. The emanations of illuminating gas are injurious. Moreover, illuminated streets would induce people to remain later out of doors, and this would lead to an increase in ailments caused by colds.

4—From the moral standpoint. The fear of darkness will vanish and drunkenness and depravity will increase.

5—From the viewpoint of the police. The horses will get frightened and the thieves emboldened.

6—From the point of view of national economics. Great sums of money will be exported to foreign countries.

7—From the point of view of the common people. The constant illumination of streets by night will rob festive illuminations of their charm.

Paris was lighted by gas in 1820. Even as late as 1833, when it was first proposed to light the streets of Philadelphia with gas, several hundreds of the



Fig. 1.



Fig. 2.

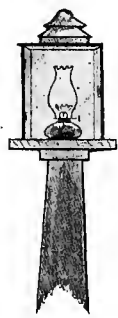


Fig. 3.



Fig. 4.

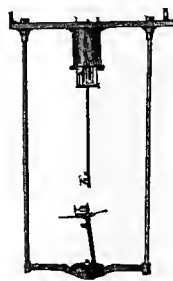


Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.

labor may now work with almost equal facility at night, as well as in the day.

In order to fully appreciate the many conveniences of today, it is well to look back to the times of our forefathers and make a comparison with our own times. In the busy life of the present we accept improvements as a matter of course, and in a short time forget that they have not been with us always. Especially is this true of public service improvements, and in particular of modern street lighting.

The early methods of lighting, the brush fires and torches, which were later followed by the candle and oil lamp, were the only means of street illumination until the early part of the nineteenth century. The first real advancement in the art came with the development of the gas lamp.

The adoption of the gas lamp for street lighting was slow, as it was such an innovation that the gen-

eral citizens signed a petition to the council protesting against its use and the system was not installed until 1836.

Many of us can recall the familiar sight of the lamp lighter making his rounds each evening lighting up these open jet gas lamps (Fig. 4). The gas lamps have continued in use in some parts of the large cities until later years, and, in fact, it was only recently that the last of these lamps were replaced in Boston with a modern electric system.

The type of electric lamp which first came into general use for street lighting was the old open arc (Fig. 5). This was in 1877. The improved type (Fig. 6) was the monarch of street lights until the invention of the enclosed carbon arc lamp in 1894. The maintenance cost of the open arc lamp was high, as a single trim would burn only from eight to ten hours. Some of these lamps were arranged with two sets



Fig. 9.

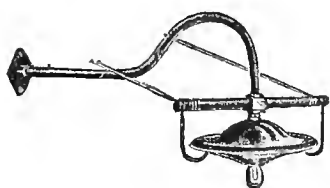


Fig. 10.



Fig. 11.



Fig. 12.



Fig. 13.



Fig. 14.



Fig. 15.



Fig. 16.

of carbons, when one set burned out the other set would automatically start up. These old open arc lamps gained the reputation of giving 2000 candlepower, as at the time they were brought out there were no photometers which would accurately record their light.

A story is told of an enthusiastic salesman who claimed 8000 candlepower for his lamp, explaining that if the lamp were installed at the street intersec-

tion there would be 2000 candlepower shining in the four directions, or a total of 8000 candlepower. Later tests show the open arc as giving a maximum of about 1200 candlepower, but the light was unsteady, being affected by the wind and rain.

The enclosed arc lamp (Fig. 7) was of much less candlepower than the open arc, or about 600 candlepower. However, the light was fairly steady, as the inner enclosing globe protected the arc from air cur-

*Polar Diagram
showing distribution of
light from new high-efficiency
mazda lamp.*

---- Type "C" 300 watt lam.
with reflector only.
—— Type "C" 300 watt lam,
with special Holophane
refractor.

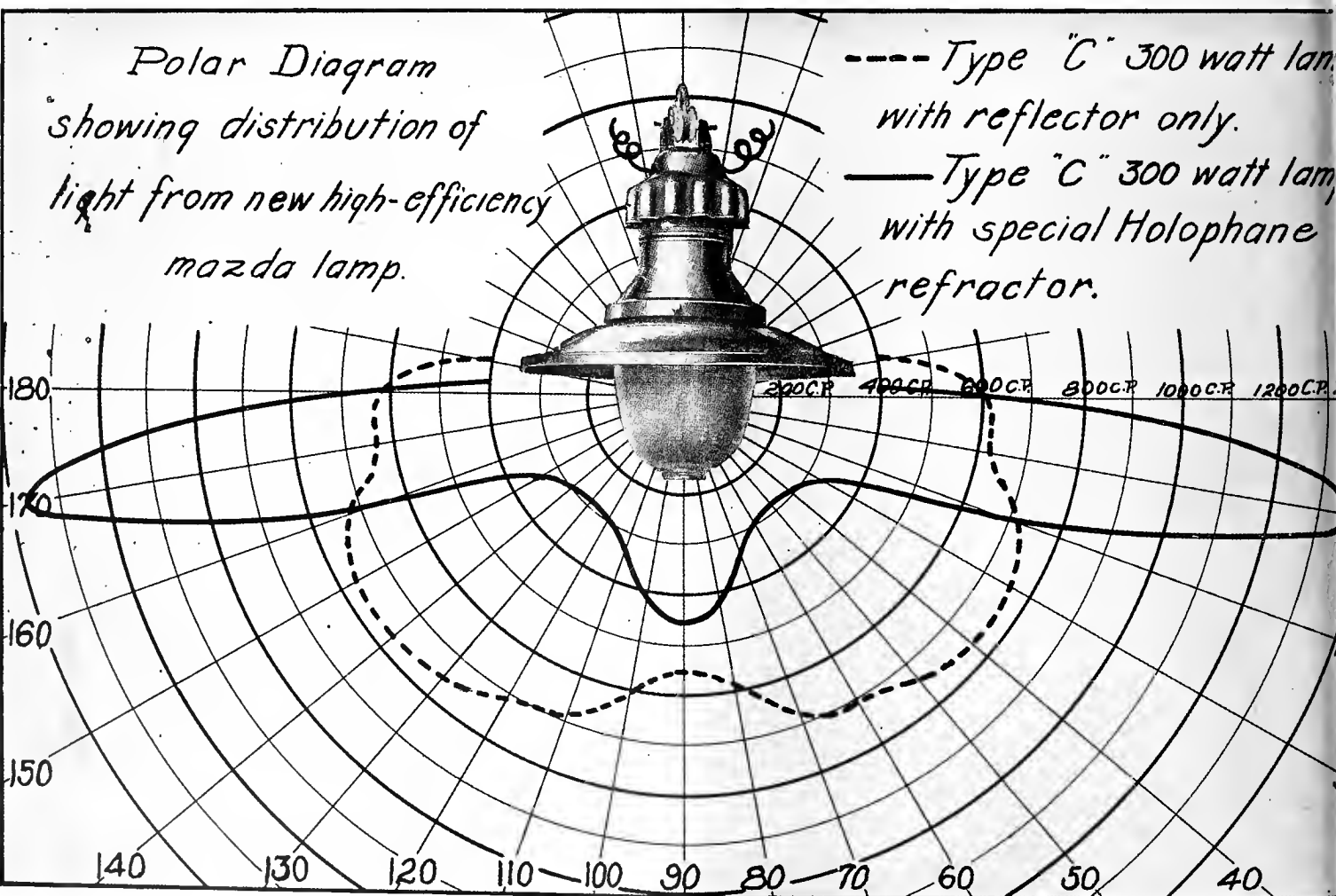
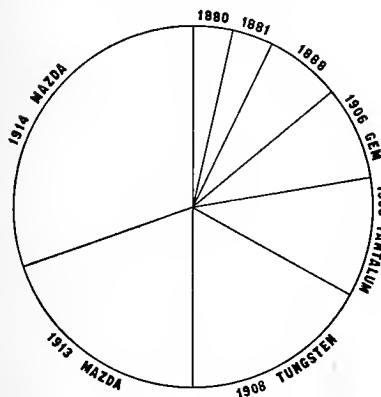


Fig. 17.

rents and the weather, also increased the hours of burning on one trim to seventy or eighty hours. This lamp continued as the favorite high candlepower unit for street lighting for some ten years, but in the last few years it was superseded by the magnetite luminous arc lamp (Fig. 8).

The magnetite lamp is peculiarly adapted to street lighting, as its maximum candlepower (about 700 candlepower) occurs at 10 degrees below the horizontal and thus sends more light to the distant points. A very even distribution of light is obtained by a proper placing of these lamps. One of the electrodes is a solid copper lug, the other a five-eighths inch iron tube filled with powdered magnetite. The copper electrode has a life of from 4000 to 6000 hours, the magnetite electrode lasts from 175 to 200 hours. The quality of light is very white and illuminated objects are given



Increased Efficiency Attained in the Incandescent Lamp

Fig. 18.

their true color values. The usual method of installation is to suspend this lamp over the street intersections; however, an ornamental standard (Fig. 9) has been designed with the lamp mechanism as a part of the post, which lends itself nicely to the lighting of more congested districts.

While the arc lamps, until recently, have been the only large units for street lighting, the incandescent lamp has been used in many places where it was found advantageous to install smaller units placed at short intervals. The fifty-five volt sixteen candlepower carbon filament lamp arranged forty in series, and supplied from a 2200 volt line, was one of the early systems. These lamps would be placed one on each pole, or every other pole, using a goose-neck bracket similar to Fig. 10.

With the advent of the tungsten lamp, an improved bracket was brought out, having a radial wave reflector (Fig. 11), by which the light was increased in the useful direction.

One of the first thoroughfares to be lighted with ornamental posts was Broadway, Los Angeles. These lights were installed in July, 1905, and mark the beginning of a form of street lighting which has become very popular. Fig. 12, 13, 14, 15, show some of the more usual types of ornamental posts.

The modern arc lamp shows no special gain in actual efficiency (watts per candlepower) over the old-time lamp, but the incandescent lamp, beginning with an efficiency of about six watts per candlepower has been improved until now the type "C" Mazda operates

at one-half watt per candlepower, and equals the most improved arc lamp in efficiency. This remarkable development is shown graphically in Fig. 18.

With the type "C" (gas filled) Mazda we have a street lighting unit which meets the demands of the most critical. Its light is absolutely steady, and it requires attention only when broken or burned out. As the manufacturers guarantee 1000 hours life it is safe to expect much longer operation. As the larger units are the most efficient it will probably be used with the single light post, one of the latest design of which is shown in Fig. 16.

The distribution of light around the incandescent lamp is approximately uniform. For street lighting the best results are obtained with the maximum intensity at ten degrees below the horizontal. This result has been obtained by the development of a special Holophane refracting globe which highest authorities claim marks the greatest improvement in street lighting since the advent of the wire-drawn tungsten filament. In Fig. 17 is shown one of the latest types of pendant fixtures designed for use with the long-neck type "C" Mazdas. The polar diagram shows how the special Holophane globe takes the light which is not needed in the vertical directions and more than doubles the useful light at ten degrees below the horizontal.

In the foregoing has been outlined briefly the methods of street lighting of yesterday and today, what the future will bring forth, it would be foolish for the wisest to prophesy.

THE MEETING OF CONVENTIONS AT SAN FRANCISCO.

More than three hundred state, national and international conventions have decided to hold their 1915 meetings in or near San Francisco. These convention meetings are arranged through the Exposition Bureau of Conventions and Societies, and as this Bureau is in touch with many societies whose meetings are to take place between now and February 20th, doubtless several more conventions will be secured.

The first convention of the Exposition series will meet of February 17, 1915, and a constant session of conventions will be held from that date until the close of the Exposition.

It is a significant fact that since the war in Europe began, state and national conventions have turned more and more to San Francisco as the logical place for their 1915 sessions. During the last fifteen days in August, fifteen conventions decided to meet here in 1915, and during September even a better record was made, as thirty-seven conventions decided to meet here. These conventions were secured in such widely distributed cities as St. Paul, Salt Lake City, Detroit, Helena, New York, San Francisco, Newburgh, Minneapolis, Atlantic City, Milwaukee and Boston. All this indicates faith in the Exposition.

A great many people in our own country who yearly travel to Europe are now able to do what they have long had in mind to do, namely, see their own country and indications are that many visitors who yearly go to Europe will visit California instead. The conventions will bring many of them here.

ELECTRIC DISTRIBUTION

STANDARDS AT SAN DIEGO.

F Street Lighting.

BY L. M. KLAUBER.

[Continued.]

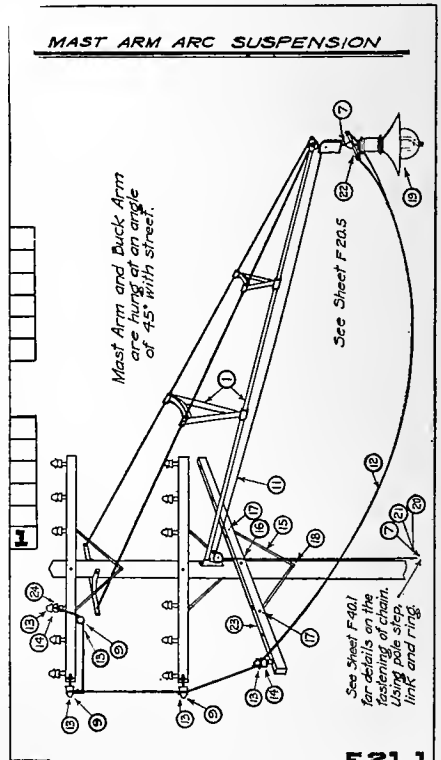
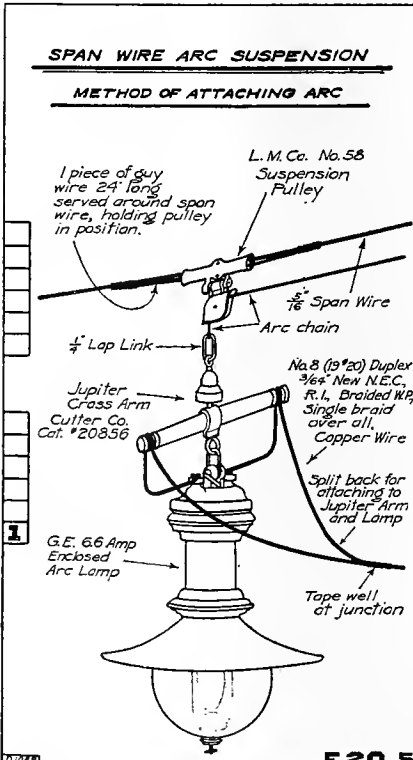
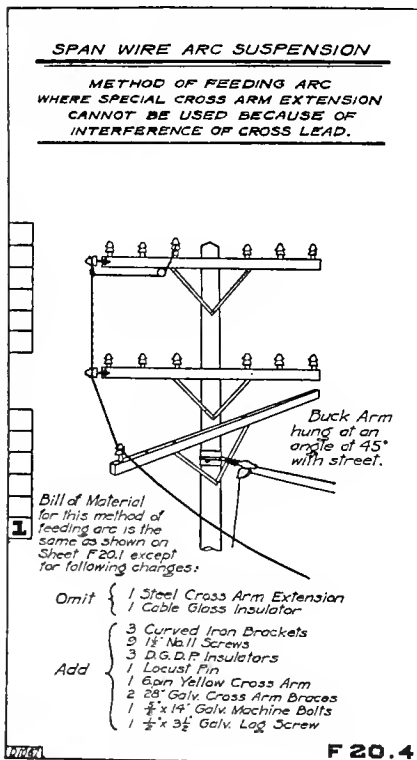
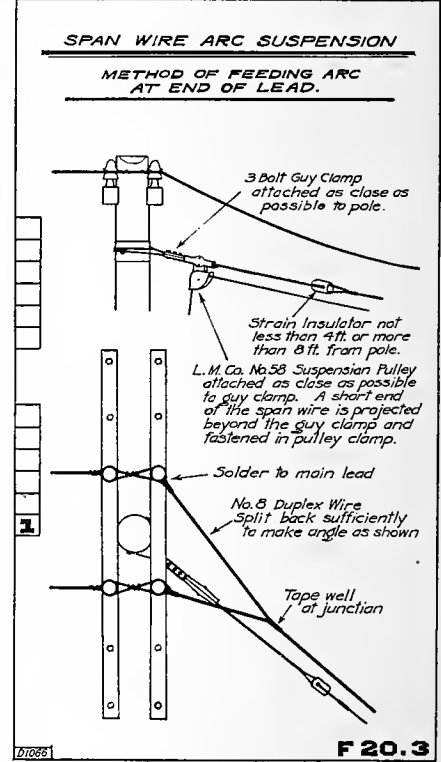
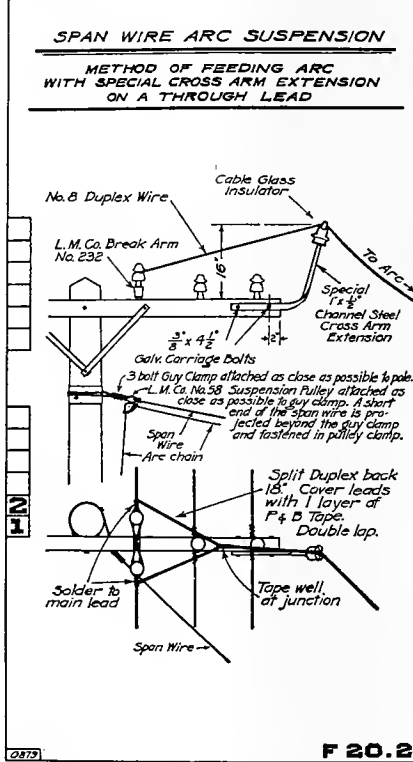
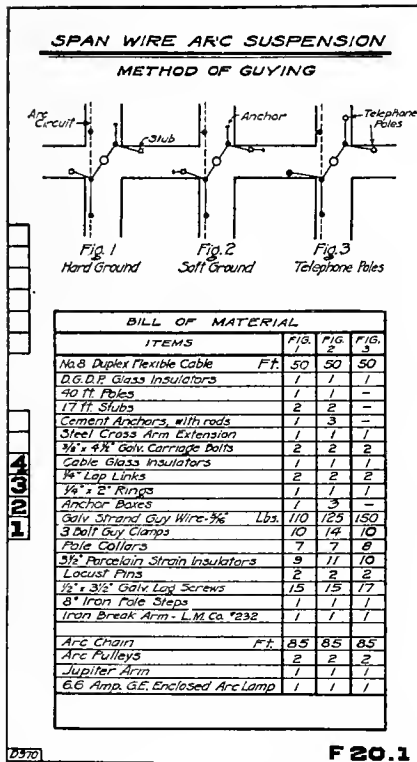
Section F contains the following information:

- F 10 Renewals for Street Lights.
- F 20 Hanging of Arcs.
- F 30 Switching Schedule.
- F 40 Hanging of Incandescents.

F 10: Renewals for Street Lights.—The information contained in this division being of local ap-

plication only, is not here repeated. Globe and lamp sizes and ratings are listed for series incandescent and ornamental block lights in the various municipalities served, thus informing patrolmen of the proper apparatus to use in making renewals.

F 20: Hanging of Arcs.—The matter contained in this division is fully explained by the cuts here re-



MAST ARM ARC SUSPENSION

F 21.2

MAST ARM ARC SUSPENSION

F 21.3

MAST ARM ARC SUSPENSION

BILL OF MATERIAL

ITEM	DESCRIPTION	QUANTITY
1	L.M.Co. No.716 20ft. Mast Arm	1
2	3/8" x 4 1/2" Turnbuckles	2
3	3/8" x 4 1/2" Machine Bolts	2
4	3/4" Nuts	4
5	1/2" x 7" Log Screws	1
6	1/2" x 3 1/2" Log Screws	4
7	1/4" Lap Links	2
8	3/8" x 2 1/2" Log Screws	1
9	Curved Iron Brackets	3
10	1 1/2" No.11 Screws (for Brackets)	9
11	Galv. Chain	50 ft.
12	No.8 Duplex Flexible Cable	50 ft.
13	D.G.D.P. Glass Insulators	5
14	Locust Pin	2
15	28" Galv. Cross Arm Braces	2
16	5/8" x 16" Galv. Machine Bolt	1
17	3/8" x 4 1/2" Galv. Machine Bolts	2
18	1/2" x 3 1/2" Galv. Log Screws	1
19	6.6 Amp G.E. Inclosed Arc Lamp	1
20	8" Iron Pole Step	1
21	1/4" x 2" Ring	1
22	Jupiter Arm	1
23	6pin Yellow Cross Arm	1
24	L.M.Co. No.232 Break Arm	1

F 21.4

produced. Sheets F 20.1 to F 20.5, inclusive, cover span suspension, while F 21.1 to F 21.4 cover mast arm suspension. As the present series arc circuits contain an average of over one hundred lamps each, particular attention has been given to the clearances between these and other circuits. Duplex wire drops to the lamps have resulted in safer construction and better appearance.

F 40: Hanging of Incandescent Lamps.—This information follows the same lines as that contained in F 20, two types of suspension being employed. Not so much care has been taken with insulation in the series incandescent circuit, for, where they are operated from the arc circuits, the former are divided into small groups and type S. L. transformers are used. This permits running the incandescent circuits on the secondary arm, and would prevent outages in the arc circuit due to a break in the less rugged incandescent apparatus. The 10 ft. mast arm has been found useful in carrying the light out beyond the trees, while the hinge feature permits renewals without difficulty.

[To be continued.]

F 30: Switching Schedule.

Time for Switching Street Lights or Signs—Hours for Setting Time Switches.

January	1st to 15th	—5:10 p. m.
January	16th to 31st	—5:20 p. m.
February	1st to 15th	—5:35 p. m.
February	16th to 28th	—5:50 p. m.
March	1st to 15th	—6:00 p. m.
March	16th to 31st	—6:15 p. m.
April	1st to 15th	—6:25 p. m.
April	16th to 30th	—6:35 p. m.
May	1st to 15th	—6:45 p. m.
May	16th to 31st	—6:55 p. m.
June	1st to 15th	—7:05 p. m.
June	16th to 30th	—7:10 p. m.
July	1st to 15th	—7:10 p. m.
July	16th to 31st	—7:05 p. m.
August	1st to 15th	—6:55 p. m.
August	16th to 31st	—6:35 p. m.
September	1st to 15th	—6:15 p. m.
September	16th to 30th	—5:55 p. m.
October	1st to 15th	—5:35 p. m.
October	16th to 31st	—5:20 p. m.
November	1st to 15th	—5:05 p. m.
November	16th to 30th	—4:55 p. m.
December	1st to 15th	—4:55 p. m.
December	16th to 31st	—5:00 p. m.

HANGING OF INCANDESCENT LAMPS

F 40.1

HANGING OF INCANDESCENT LAMPS

SPAN SUSPENSION

F 41.1

A RESUME AND COMPARISON OF RATE THEORIES.

BY STACY HAMILTON.
[Concluded.]

No. 4. Two-Charge Demand Rate (Hopkinson Rate).

Briefly, this is a rate of so much per unit of demand, plus so much per unit of energy consumed.

Compared with flat and straight meter rates, this rate is rather more complicated and not easily explained to the layman. The average consumer does not usually take kindly to a demand charge, especially a consumer with a low load factor. This attitude is due largely to the popular idea that electric service is merely the furnishing of so many kilowatt hours of energy. The rapidly increasing efficiency of lamps has rather forcibly called to the attention of the central station the necessity of emphasizing to the public the fact that electric service is largely a service and not merely a commodity. Where water power generation predominates, as is almost universally the case on the Pacific Coast, the mere energy furnished is usually only a very small part of the cost of rendering the service, and it becomes more important every day for the general public to be properly informed of this fact. The common use of the kilowatt hour alone as the unit of service is largely to blame for the present public attitude regarding demand charges in connection with a low energy charge.

This rate is more theoretically correct than those previously discussed, as it more closely conforms to the cost of rendering the service under varying conditions of operation. In the case of large consumers it also has a distinct advantage, from the value of service standpoint, as it automatically conforms to the consumer's cost of furnishing the required service by means of an independent plant. If such a consumer has long hour use of his equipment, his unit cost with an independent plant will naturally be comparatively low, and the central station's rate, when applied to such operating conditions, must necessarily be low also in order to compete. On the other hand, if the consumer has only a short hour need of his equipment, his independent plant unit cost will be comparatively high. As provided under the Hopkinson system, the central station's rate for such a condition will also be proportionately higher, and rightly so, not only from the standpoint of higher unit cost of furnishing the service, but also because the service is worth more per unit to the consumer on account of his own higher cost of furnishing it from some other source. In this instance, therefore, the Hopkinson system, while conforming nearer to the cost of service theory, also embodies to a certain extent the value of service theory.

References to opinions on two-charge demand rate (Hopkinson rates):

- Wisconsin Railroad Commission.**
Milwaukee Electric Railway & Light Company, 6 W. R. C. R. 64, 68.
Red Cedar Valley Electric Company, 6 W. R. C. R. 717, 758.
Decision 8/20/1912, Establishing Hopkinson Rate for the Milwaukee Electric Railway & Light Company.
Decision 11/4/1913, Establishing Hopkinson Rates for the Chippewa Valley Railway, Light & Power Company.
- Montana Public Service Commission.**
Decision 11/3/1913, Establishing Hopkinson Rates for the Helena Light & Railway Company.
- Illinois Public Utilities Commission.**
Decision 5/6/1914, Establishing Hopkinson Rates for the Western United Gas & Electric Company.

No. 5. Wright Demand Rate.

This form or rate brings in the demand feature of the charge by a comparatively high primary rate

per kilowatt hour for a certain number of hours' use of the consumer's demand, with the balance of the monthly consumption at a much lower rate. The resultant rate curve is somewhat similar to that of the Hopkinson rate, although the expression of the rate is usually more complicated. It differs considerably from the Hopkinson rate, however, in the lower load factors, as, from the nature of its expression, it puts a limit on the maximum rate per kilowatt hour, with the result that consumers with extremely low load factors escape part of their proper portion of the demand charges.

The chief advantage of this rate seems to be in the fact that the stand-by or demand feature of service is included in the charge, and yet the more or less unpopular expression of a direct demand charge is avoided. In practical application such a rate has the advantage of all charges therein being expressed on the kilowatt hour basis, to which the average consumer is accustomed and can more easily comprehend. This rate can hardly be said to conform as closely to cost as the Hopkinson rate, on account of the maximum limit per kilowatt hour previously referred to. There is usually, however, more or less of a popular demand for a schedule directly expressing the maximum rate per kilowatt hour to be charged and considerable pressure brought to bear to keep down the maximum. Such maximum rates are sometimes embodied in franchises, and often prescribed in rate-fixing ordinances of municipalities.

The Hopkinson two-charge rate, limited by such a maximum per kilowatt hour, is, in effect, converted into a Wright demand rate.

The latter has been recommended or ordered in a number of cases by the

Wisconsin Railroad Commission.

- Decision 11/18/1913, Establishing Wright Demand Rates for the Milwaukee Gas and Electric Company.
Decision 4/6/1914, Establishing Wright Demand Rates for the Monroe Electric Company.

Also New York Public Service Commission, 2nd District.

- Decision 4/2/1913, Recommending Wright Demand Rates for the Buffalo General Electric Company.

California Railroad Commission.

- Decision 7/29/1913, Establishing Wright Demand Rates for the Tuolumne County Electric Power & Light Company.

No. 6. Doherty Rate.

This rate is similar to the Hopkinson rate, with the addition, however, of what is called a customer charge, which is intended to distinguish that portion of the cost of service which is directly caused by the consumer being connected to the company's system, whether or not any demand is made on the company's system or any energy is used. The chief, if not only, objection to this form of rate is its tendency to appear complicated to the layman. The average consumer does not favor the idea of being called upon to pay a demand charge, especially when he uses no energy. The addition of the customer charge as a separate and distinct item from the demand charge adds to this objection. The successful use of a rate of this kind usually requires time and more or less expense in educating consumers to the fact that the stand-by or readiness to serve feature is the chief cost of rendering service, and that the actual energy furnished is only of secondary importance in the total cost.

This rate possibly conforms more closely to individual cost of service than any other general rate

which has been offered up to the present time, as it directly itemizes the three general elements of the cost of serving the individual consumer. The customer charge is most prominent and of most importance in a rate for residence service. An analysis of the cost of serving this class of consumer indicates that the customer costs are a very prominent part of the total cost and will become more so as lamp efficiency increases. In the total cost of serving large consumers, however, the customer charge, being practically constant for all sizes of consumers, becomes relatively insignificant, and the value of a separate and distinct customer charge in such cases is not so important as in the case of residences and other small consumers.

No. 7. Guarantee Rate.

This form of rate may or may not include the demand element. Its usual form is a decreasing scale of charges per unit of either demand or energy, or both, with a corresponding increase in the minimum revenue guaranteed by the consumer. The successful application of such a rate depends largely upon the policy adopted in applying the guarantee. If the consumer is properly assisted by the central station in determining the guarantee most advantageous to his load over a period which will cover all probable variations of the consumer's operating conditions, such a rate will work out quite satisfactorily. If, however, the consumer is allowed to choose a guarantee which is later found to result in a higher charge than he might have obtained under a higher or lower guarantee, he is quite often apt to lay the blame at the door of the company, and in any event he will be more or less dissatisfied. Such conditions will be measured by the extent to which the company is willing to go in making readjustments of the consumer's guarantee. Perhaps the chief disadvantage of this form of rate is the necessity of frequently making such adjustments. A rate of this kind is quite apt to result in discrimination between individual consumers, causing more or less dissatisfaction and criticism from the public and the regulating authorities.

The chief advantage of this rate lies in the simple form in which it may be expressed, and, consequently, easily understood by the consumer, this basis of differential in unit charges being rather common in other lines of business.

No. 8. Consumers' Output Rate.

This form of rate represents a charge for electric service, usually for power, based on the output of the product which the consumer is manufacturing. Unless the consumer's output can be quite definitely predetermined for the entire term of the contract under which this rate is given, and unless the efficiency with which the consumer manufactures his product can be sufficiently guaranteed to the supplying central station, such a rate is not likely to be at all satisfactory to the latter. This form of rate imposes on the central station whatever risk and uncertainty may exist in maintaining the efficiency of the consumer's plant and the demand for his product, and this, usually, under conditions which are entirely out of the control of the central station. For these same reasons, such a form of rate is, of course, quite satisfactory from the consumer's standpoint.

It may, however, be used to advantage under conditions where a new field of electric service is being developed, and the prospective consumer is not willing to accept the risk and uncertainty of the effect of the new service on his costs.

No. 9. Off-Peak Rate.

The rates previously mentioned usually apply to general service; that is, unlimited 24-hour service. As the average central station seldom enjoys a yearly load factor better than 40 to 50 per cent, it is quite evident that its system of rates should give all encouragement possible to the development of off-peak loads. Off-peak concessions are quite often expressed as entirely separate and distinct schedules, while in other cases they are covered by some form of discount or other form of differential applied to one or more of the company's standard rates for 24-hour service.

The justification of the off-peak rate depends largely upon the company's ability to know that the load is a bona fide off-peak load. At the present stage of meter development, this assurance is rather costly, and, in case of small loads, it is often questionable whether the cost and operation of the necessary meter equipment is justified. Where conditions are such as to justify the installation of a separate system of mains and services which may be controlled from the central station, the individual meter expense can, of course, be avoided.

Off-peak concessions in charge are undoubtedly destined to be an important feature in the rate systems of central stations. This is assured by the rapidly increasing use of electric vehicles, irrigation, electric furnaces and other loads which can readily be made to conform to the off-peak conditions required by the supplying company.

Recognition of the equity of off-peak rates is found in the following:

Massachusetts Board of Gas and Electric Light Commissioners.
Edison Electric Illuminating Company of Boston, Mass.
G. & E. R. 1903—46.

New York Public Service Commission, First District.
Report 1910, Vol. 4, page 14.

New York Public Service Commission, Second District.
Decision 4/2/1913, Recommending Off-Peak Rates for Buffalo General Electric Company.

Wisconsin Railroad Commission.
Decision 8/20/1912, Establishing Off-Peak Rates for the Milwaukee Electric Railway & Light Company.
Decision 4/6/1914, Approving Off-Peak Rates for the Monroe Electric Company.

Illinois Public Utilities Commission.
Decision 5/6-1914, Approving Off-Peak Rates for the Western United Gas & Electric Company.

Choice of Rate Form.

In the existing rate systems, various combinations of the best forms of rates will be found. Just which form of rate it is found advisable to use often depends on local conditions, and, more or less, on the precedent established by the central station's previous system of rates.

Differentials.

In most of the above-mentioned rates there will often be found a scale of differentials for quantity of consumption or demand, or both. Even power factor is sometimes recognized by basing the demand charge on the k.v.a. unit, rather than the kw., and in nearly all schedules, for residence lighting at least, a discount is allowed for prompt payment.

The Wisconsin and California Commissions have recognized the equity of differentials for quantity in consumption and demand charges in the following:

Wisconsin Railroad Commission.
Jefferson Municipal Electric Light and Water Plant, 1910-5-W. R. C. R.-585.
Decision 8/20/1912, Establishing Rates with Differentials for Quantity of Demand and Consumption for the Milwaukee Electric Railway and Light Company.

California Railroad Commission.
Decision in Case 297, Town of Willets vs. Willets Water and Power Company.

The form of differential for quantity of either consumption or demand is usually found in a scale of discounts or rates per unit expressed in either the step form or block form. The latter is the most desirable, as it does away with the inconsistent feature of the step scale of differentials which results in a greater charge being made for a smaller quantity at the point where the step changes to the next lower rate or discount. The block form of differential has been advocated in numerous instances by the Wisconsin Railroad Commission, and while it is perhaps a little more complicated for the layman to compute, it is quite simple in expression, and if properly worded, can cause no confusion or misunderstanding.

Determination of Demand.

In the application of demand rates, the determination of the demand is an important detail. Various methods are used, usually one of the following:

1. Actual measurement by permanently installed demand meter.
2. Measurement by periodical test.
3. Estimate based on investigation of operating conditions.
4. Arbitrary rating based on a percentage of the connected load.
5. Arbitrary rating based on floor area.
6. Arbitrary rating based on assessed value of premises.

The first method, on account of the meter expense involved, is necessarily limited to large installations. Where the size of the load does not warrant a permanent demand meter, a periodical test may be made during the probable peak load of the installation, as indicated by the operating conditions. For the smaller power loads, the third and fourth methods are often used. For the large majority of lighting loads, the fourth method seems to be the most widely used, and has been accepted by the Wisconsin Railroad Commission and the New Jersey Board of Public Utility Commissioners.

Wisconsin Railroad Commission.
Ripon Light and Water Company, 1910. 5-W. R. C. R.-36.
Red Cedar Valley Electric Company, 1911. 6-W. R. C. R.-717-762.
Decision 8/20/1912, Establishing Demand Ratings for Milwaukee Electric Railway and Light Company.
Decision 11/4/1913, Establishing Demand Ratings for Chipewya Valley Railway, Light and Power Company.

New Jersey Board of Public Utility Commissioners.
Decision 5/19/1913, Establishing Demand Ratings for the Public Service Electric Company.

Floor area has been used to a limited extent. Good examples of this form of demand basis are given in the rates of the Duquesne Light Company, Pittsburgh; the Hydro-Electric Commission of the Province of Ontario; and the Suburban Electric Light & Power Company, St. Louis.

The assessed value of the premises has been used as a basis for the demand charge by the City of Sheffield, England.

As previously stated, the connected load basis is

perhaps the most widely used at the present time, and will give a fairly satisfactory basis for the demand rating if applied subject to correction by actual test or measurement in those individual cases where the arbitrary percentage of the connected load is manifestly working a serious injustice to the consumer. The chief objection to it, especially for residence lighting, is that it tends to penalize the use of convenience lights. This may be minimized, however, by a proper classification of the lamps used. The advantages claimed for floor area as a demand basis are that it puts no penalty on convenience lights, and is not subject to the changes that are inherent with the connected load. It also protects the company's revenue, to a certain extent, against reduction due to increases in lamp efficiency. For the same reasons, the assessed value of the premises has, at least in one instance, been used as the demand basis.

Minimum Charges.

The minimum charge of a central station, especially for residence lighting, has been a source of considerable discussion and criticism in almost every community. It has been quite generally recognized by various commissions and courts that a minimum charge within reasonable limits is justifiable.

Supreme Court of Kansas.
Cunningham et al. vs. City of Iola et al., 119 Pacific Reporter, 317.

Massachusetts Board of Gas and Electric Light Commissioners.
Edison Electric Illuminating Company of Boston, Mass. Massachusetts Gas & E. R. 1910-40-41-42.
North Adams Gas Light Company. Massachusetts Gas & E. R. 1912-22.

Missouri Supreme Court.
State ex rel. vs. Sedalia Gas Light Company, 34 Mo. Appl. 501.

New Jersey Board of Public Utilities.
Memo. in re. Minimum Monthly Charge, N. J. B. P. U.-1/16/1912.
Ocean City Gas Light Company, N. J. B. P. U., 7/19/1912.

New York Supreme Court.
Gould vs. Edison Electric Illuminating Company of New York, 60 N. Y. Supplement, 559.

Ohio.
Ohio Laws, 1911. No. 325, Sec. 19.

Tennessee.
Tennessee Chancery Case 8368.

Washington Public Service Commission.
Seattle Light Company, W. P. S. C. No. 683-11/16/1912.

Wisconsin Railroad Commission.
Appl. Lancaster Electric Light Company, 1910, 6 W. R. C. R. 53-57-59.
Appl. Greenwood Municipal Light Plant, 1910, 6 W. R. C. R. 60-61-62-63.
Appl. Bloomer Electric Light Plant, 1911, 6 W. R. C. R. 506-517.
City of Manitowoc vs. Manitowoc Electric Light Company, 1910, 5 W. R. C. R. 360-389-390.
City of Ripon vs. Ripon Light and Water Company, 1910, 5 W. R. C. R. 1-41.

There seems to be considerable difference of opinion, however, as to just what constitutes a reasonable minimum charge. The minimum charge of most central stations is intended to cover the minimum cost of serving a residence consumer, considering all items entering into such cost, including customer charges and demand charges. If such cost is to be taken as the basis, an analysis of a company's expenses, both capital and operating, will no doubt justify a minimum charge of at least \$1.00 per month. In practice, however, the minimum charge is often arbitrarily determined by local conditions, especially where direct competition exists, and whatever losses are caused in rendering service at a minimum charge of less than \$1.00 are absorbed by the rate charged those consumers whose monthly consumption runs over the minimum charge, or by some other class of consumers.

The popular objection to paying a minimum charge, as well as the frequent criticism of the high residence rates per k.w.h. as compared with com-

mercial lighting rates and power rates per k.w.h. are, to a large extent, due to the long established practice of basing electric charges solely on the kilowatt hour unit. This has naturally resulted in creating the general impression that the company is merely selling a commodity of so many kilowatt hours of electric energy. Looking at it from this standpoint, the layman quite naturally comes to the conclusion that when he uses little or no energy during the month, the company has not right to expect him to pay the minimum charge of 50c, 75c or \$1.00, whatever it may be. For the same reason, the standby charge of so much per kilowatt of demand in addition to an energy charge, as expressed in the Hopkinson rate, or Dorothy rate, comes up for criticism, and even intelligent business men are frequently heard criticising this so-called standby charge as an unreasonable extortion, robbery or some such flattering term, when it is merely the expression of the rate which has aroused their ire.

A detailed analysis of the cost of serving the average residence consumer of almost any central station on the Pacific Coast, where water power is largely prevalent, will show that the energy actually consumed is only a very small factor in the total cost of rendering the service, and any system of rates for this class of load which, in its expression, will bring out more clearly that electric lighting, heating, power, etc., is, first of all, a service rather than a commodity, will undoubtedly have a tendency to turn popular opinion in the right direction.

A very large percentage of the total cost of serving the individual residence consumer is composed of customer expenses and demand expenses, and, as the average residence load factor is usually rather low, from 10 to 20 per cent, it naturally follows that the cost of serving such a consumer is quite high per kilowatt hour, and makes a very unfavorable comparison with the low rates per kilowatt hour charged for the higher load factor commercial lighting and power consumption. It is rather hard for even the average business man to understand how a central station can justify a residence rate of from 6 to 10 cents or even higher, and at the same time serve commercial lighting and large power users at rates down as low as one cent, the energy consumed by both classes of consumers being manufactured by the same machinery. The average man in business, accustomed as he often is, to turning over his capital two to four times in one year, does not always appreciate the position of the central station, which can not expect to turn over its investment more than once in eight or ten years. Under the latter condition, the standby or investment feature of the service is decidedly a large factor in the cost, and the commodity feature of the energy furnished is a comparatively small factor, especially in the case of water power generation. Hence the importance and justification of minimum and service or standby charges for electric service.

While local conditions will continue to have more or less influence on the basis of and form of the central station's system of charges, it is highly desirable that uniformity in the form of rate schedules be attained, as far as possible, by a universal adoption of the best of the various rate theories and schedule forms now in use, and the elimination of the balance.

DISCUSSION OF RATE THEORIES.

(These are stenographic reports of three illuminating discussions on Mr. Hamilton's paper, before the Northwest Electric Light & Power Association. —The Editor.)

F. S. Burroughs (Chief Engineer of Washington Public Service Commission): I saw this paper for the first time today, and the question of rates is one that I believe should be considered seriously, one it is rather dangerous to tackle without thinking it over carefully first. The more I study the rate question, the more I think the cost of service nearly approximates the schedule of rates.

The question of value of service is too apt to mean what the patron will pay. Determining what the service is worth is harder than determining what the actual cost is. You have to convince the patron what the value is.

Practically all the expense of furnishing electric service comes under the head of "Fixed cost." All of your expense is largely made up of your investment charges and your consumer expenses. The question of output expense is relatively small. What you want to do is to increase your load factor and increase your fixed charges per unit of output. The way to do this is to diversify your load.

Mr. Hamilton said that the Pullman berth charge is a fair example of the value of service. The upper berth being the larger is an example of the cost of service. Certain of the charges must necessarily be tied up by the 16 lower berths, while the cost of 16 upper berths necessary to make the sections, have increased your sale capacity for that car, so you clearly have increased the load factor and decreased your overhead expense per unit of car service. Also there is a larger percentage of your investment can be elected to the lower berths for the reason that you have first, a car with seats in it. By putting in the upper berths you have only to charge an additional expense and, at the same time, it splits up the original cost per berth.

In regard to the form of a rate, I do not like to say much, for a number of reasons. The form of a rate depends largely upon what the public is used to. In one community you might charge one rate, in another something else. The form of a rate is largely a matter of public education.

It has always appeared to me that the steps to be taken in preparing a rate would be, first: determine those classes of expense which vary directly with the classes of consumers. For some, the meter rate way of preparing a bill, added to this interest on investment for improvements made exclusively for the consumer's benefit. For others you have to charge a stated amount per month for service; don't tell them it is a maximum charge, just tell them that it is a service charge, and then charge them for the actual electricity which he uses. That puts the company in the position of a vendor of a commodity which, of course, it is not. If you cannot get the people to accept that, have a set rate. Make a rather high initial charge and step down.

Mr Hamilton mentioned competitive business and the necessity of making low rates on account of competition. This is all right if not carried to extremes. But you must remember business is not worth getting unless you get at least the cost of service. The consumer must pay per unit of consumption a profit upon the general plant, and upon a portion of the general expense, but not necessarily as large a profit per unit of consumption as the man who only uses a few kw.-hr.

C. M. Fassett (Commissioner of Public Utilities of Spokane): When I listened to Mr. Hamilton's able paper, I was sorry that Mr. Cotton wasn't there to listen to some of Mr. Hamilton's discussion on rates. He might then have concluded that he was mistaken about the ease with which the rates for a gallon of water or a gallon of gas can be made.

[Continued on page 394.]

LOS ANGELES AQUEDUCT MISTAKES.

BY CHARLES E. WARNER.

(The startling accusations in this paper are an abstract of an address by the author before the Oregon Engineers' Club at Portland, on October 8, 1914, under the title of "Some Hitherto Unmentioned Features of the Los Angeles Aqueduct." Comment is invited.—The Editor.)

In a Los Angeles paper I recently noted an account of a sanitary investigation of the water of the Los Angeles Owens River Aqueduct by Ethel Leonard, B. S. M. D., in which it is stated that "even bacteria cannot develop in such polluted water." As chairman of the Aqueduct Investigation Board of Los Angeles, I wrote a report August 31, 1912, in which I endeavored to state conservatively such facts as the one referred to by Dr. Leonard.

The Los Angeles Aqueduct has been advertised to the world as a great public undertaking, an engineering success and a triumph of municipal enterprise. As constructed, it takes water from the Owens River in Inyo County and carries it about 240 miles due south to the San Fernando Valley at a point 24 miles north of Los Angeles.

The investigation referred to was conducted at great length by the Investigation Board and a large staff of experts. Numerous trips of inspection and months of study and examination of witnesses preceded the final conclusions arrived at. I, personally, walked 200 miles on one trip of examination.

The actual conditions found in the investigation of this great aqueduct were a shock to the friends of honest municipal operation. The men who signed the report of the Aqueduct Investigation Board were all friendly to municipal operation and hated to find what they could not in honor refuse to see.

More than thirty million dollars were spent by the taxpayers of Los Angeles for that aqueduct.

The aqueduct was not needed.

Los Angeles already owned a supply of good drinking water sufficient for one million people and only a part of the water available near Los Angeles has ever been conserved or developed for use.

The aqueduct water is fit for irrigation only, and a citizen of Los Angeles is now in court trying to prevent the water bureau officials from turning that water into the city mains.

The aqueduct was announced to the Los Angeles people in July, 1905. It was discussed in secret by a number of people for two or three years prior to that and was "sprung" at a time and in a manner to sweep people off their feet.

Certain dry lands north of Los Angeles received great benefit from the aqueduct. Large areas of these lands, amounting to thousands of acres, belonged to a few influential politicians of Los Angeles. The aqueduct scheme was originally proposed to the "inside crowd" by a former Mayor of the city. This ex-Mayor was entrusted with funds and asked to purchase large tracts of land in Owens Valley and Long Valley. When the deeds were signed, it was found that the ex-Mayor had kept for himself more than half of the land and all the cattle, about 5000 head. For reasons best known to themselves, the city officials could not compel the ex-Mayor to give up the land he had kept. This necessitated doing away with the

principal storage reservoir and reduced the quantity of water about two-fifths.

The aqueduct intake is at nearly the lowest point in the Owens Valley. The water here carries nearly all the seepage, sewage and drainage of the towns and farms of the valley. From the intake to Haiwee reservoir is 60 miles of open ditch partly lined, partly unlined. A considerable number of desert animals fall into this section and drown, floating down into the big reservoir. The capacity of the ditch is 900 c. f. s., or 45,000 gal. miners' inches. Haiwee reservoir has 64,000 acre feet capacity.

Below the Haiwee reservoir the aqueduct is enclosed and has a capacity of 400 c. f. s., or 20,000 inches.

It is 135 miles from Haiwee reservoir to Fairmont reservoir and the conduit runs through desert and mountains all the way. There are a number of steel inverted siphons across canyons and many long tunnels through the mountains.

Fairmont reservoir has 7600 acre feet capacity. South of this a tunnel was driven over five miles long. Below here the conduit runs through about 40 miles of dry country with more tunnels and inverted siphons, till it reaches the San Fernando reservoirs, one of 16,000 and the other 21,000 acre feet. Below these reservoirs lie the large land holdings previously mentioned. From this point to Los Angeles only a relatively small pipe was to be installed.

The transportation of supplies for construction was a tremendous task. Twenty-eight caterpillar engines and ninety-four trail wagons were bought for this purpose and operated for several years at an estimated cost of 20 to 25 cents per ton mile. In 1910 this cost suddenly jumped to 65 cents per ton mile, the caterpillars were discarded and hundreds of mules purchased. Incidentally, eleven caterpillar engines and twelve trail wagons have never been accounted for. They cost \$47,610. Our most persistent inquiries failed to elicit any information. Like the Indians' wigwam, they were just "lost."

The concrete work was extremely unfortunate, but furnished an interesting example of the practical effect of adulterants. An attempt was made to duplicate some of the concrete work of Italy, in which enters a volcanic material known by several names, one being tufa. Three quarries were opened along the general location of the aqueduct and a supposed tufa was mixed with a large portion of the cement. The best opinions indicated that the supposed tufa was in reality a clay. A Los Angeles brick manufacturer made very fine sample bricks of it. Anyway, its effect on concrete was just the same as clay. It made a good piece of work if kept moist about one month, but its set was extremely slow. In the tunnels, it had an opportunity to set and usually the tunnel concrete was good. On the desert, however, it was doomed from the start. I have photographs showing where it has crumbled like poor adobe. Some of the piers under the big steel siphons are like gypsum, soft and crumbly. I have other photographs showing where several of the concrete ribs of the aqueduct roof were kicked over by one man and shattered as they tipped over.

It is only a question of a short time when several

million dollars will have to be spent in replacing this poor concrete. Many breaks have already occurred.

A large cement plant was built for aqueduct cement. It produced less than 700,000 barrels and the net cost was \$2.84 per barrel.

It seems to me that engineers today ought to try to reach outside of technicalities and consider the public effect of things. There are many things that might be done for the general benefit. There are other things that may be attempted which will be of doubtful benefit to anyone. A body of men such as yours can exert a great influence, and I am glad to be able to give you this example of some of the things to be avoided.

The State of Oregon and the entire Northwest is threatened with a mis-application of its resources. There is a general feeling that things are not right and that something must be done. Something can be done. I am working toward that end, myself. I see a great development pending in this section. We have great resources which can be made the basis of general prosperity for all who live and work here. On the other hand, no community is proof against such things as I have referred to concerning the Los Angeles aqueduct. I recommend to you the careful consideration of a definite programme for engineering development along sane but progressive lines.

U.S. GEOLOGICAL SURVEY WORK IN OREGON

As the result of laws passed by the Oregon Legislature, particularly in 1911, Oregon is just beginning to reap the benefits of a large amount of co-operative investigation made by the state and by the United States Geological Survey. The state and the survey have been spending equal amounts in the work in Oregon in accordance with these laws, and many topographic maps have been completed, stream flow measurements made and water resources investigated. The resulting maps, bulletins and statistics are of great value to all persons interested in Oregon.

Since the original topographic map bill was passed, the following sheets have been surveyed co-operatively and published: Mitchell Butte, Blalock Island, Umattilla, Eugene, Halsey, Oregon City and Boring, with a total area of about 35000 square miles. These maps are among the finest made and they are really the only one of these areas that have any claim to accuracy. They are on scales of $\frac{1}{2}$ to 1 inch to the mile, and are in several colors and show every detail, even the houses. They also show accurately all elevations, and are sold for the small sum of ten cents each by the Geological Survey at Washington or by stores in Portland.

In addition to the above maps the Survey has also published during the past four or five years the Mt. Hood, Grants Pass and Crater Lake sheets, which were made out of its own funds and in addition to the co-operative work. The Survey has also issued six large lithographed maps of the upper Willamette valley on a scale of 2 inches to the mile, with five foot contours, intended primarily for drainage and development purposes. These maps are all in colors. Among other existing sheets are Roseburg, Riddle, Coos Bay, Port Orford, Portland, Ashland, Klamath, Baker,

Sumpter, Ironside Mountain and Telocaset, all for sale at ten cents a copy.

The increased appropriation was made in 1911 and since that time three new sheets have been surveyed but not yet published, though they will soon be issued. They are Pine, Arlington and Albany. In addition the Survey completed the Cazadero sheet with its own funds. Besides this finished work, the survey has partially completed the following sheets with co-operative funds: Salem, Reedville, Condon, Corvallis, Lebanon, Monroe, Hillsboro, Brownsville and Elmira, and in addition has done a great deal of control work on the Dallas, Aumsville, Mt. Angel, McCoy, Heppner, and several quadrangles in the John Day Valley. It is expected that the Condon and Reedville sheets will be completed this fall. The survey will also probably finish the Diamond Lake sheet out of its own funds this fall and start the survey of the Kerby sheet.

In the water resource work the Survey has completed maps and stream investigations on a scale of two inches to the mile of the John Day, Deschutes, Metolius, Hood, Sandy, Clackamas, Santiam and Middle Fork of the Willamette. This was done under the co-operative agreement, and the maps and bulletins covering these streams will be published in a few weeks. In fact the Deschutes River report, which will be the most valuable report ever issued for that territory is now on the press. The Survey has just issued Water Supply paper No. 363 covering the "Quality of the Surface Waters of Oregon" which gives the chemical and physical analyses of all the important lakes and streams in the state. This paper is invaluable to all persons who desire to use water for development purposes in Oregon, and may be had free from the Survey at Washington, D. C. Water power development in Oregon cannot be had without full and complete knowledge of the streams in question, such as is gathered by the state engineer and Geological Survey.

In this connection it should be noted that the so-called George bill, purporting to abolish the Desert Land Board, which is soon to be voted on, will also abolish the present office of state engineer and bring all this investigation work to an end. The Portland Chamber of Commerce and many other organizations are fighting the bill on the grounds that it will seriously hamper the development of the state if it passes. There are many places in Oregon that are anxious for topographic maps, but if the George bill passes, the topographic map work will stop, and in addition the sheets that are partially completed will be stopped also and Oregon will have her funds tied up and unavailable. A number of important power streams are not yet mapped, particularly the Umpqua and the Rogue. The George bill should be decisively defeated because of the harm it will work against the state's progress.

Corrosion of cast-iron pipe can be minimized by surrounding it with lime in the trenches in which it is laid. It is also suggested that the trenches not be covered, as the alternate wetting and drying would be preferable to the constant exposure to moist air, salt and carbonic acid in marshy soil.

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A CORRECTION.

In the notice of the plan to hold the national A. I. E. E. meeting at San Francisco in 1915, September instead of April should have been stated as the possible date for a special meeting.

A valuable service has been performed for the Western gas man by Mr. R. S. McBride in the leading article of this issue. Gas is no exception to the rule that engineering and sales conditions are different in the West. Yet it is interesting

Standards for Gas Service

to note that the general standards already established for gas service by the U. S. Bureau of Standards are applicable to local conditions. Any points of difference, particularly as regards the manufacture of gas from crude oil, have been carefully analyzed by Mr. McBride and his conclusions are worthy of careful consideration by Pacific Coast gas men.

The West is peculiar in that many companies supply both gas and electricity to their consumers, services ordinarily considered as competitive. Yet by selling electric current for lighting and gas chiefly for cooking and heating, each service is being made to supplement the other. The mild climatic conditions on the Coast favor this division of functions, so that many consumers find it an advantage to have both services.

Serious attention has been given to the utilization of off-peak electric current for the generation of oil-gas, but in the light of present knowledge this does not seem as feasible as the manufacture of electric furnace products.

While Mr. McBride's work was largely in response to the need of public service commissions for more definite information as to proper standards for gas service it has been made possible only by the co-operation of the corporations. Most gas companies voluntarily maintain higher standards of service than have yet been suggested by regulating bodies, realizing that all standards are relative and that the definite standard for each individual is the highest ideal of service of which he can conceive.

Even the most enthusiastic co-operator is occasionally assailed by doubts and doubters of the real "worthwhileness" of co-operation.

The Fruit of Co-operation

The good things of this life often seem to gravitate to those who appropriate them without regard to the rights of others. An honest effort to get together for the common weal is misconstrued as a confession of weakness. Competition seems to succeed where co-operation apparently fails. At least we sometimes have our misgivings.

Yet consider a while. All things in nature are arranged in pairs, everything has its counterpart. Heat and cold, light and darkness, positive and negative, optimism and pessimism, good and evil, co-operation and competition. If one did not exist, neither would the other. Competition is the shadow of co-operation.

Co-operation does not mean merely getting together, but acting together. It does not mean cessation of effort, but simply a change in the direction in

which effort has been exerted. Co-operation is action, competition reaction. The conflict between action and reaction is universal and continuous. In the end, however, the eternal law of progress throws the balance in favor of the bright side and compensates for the darkness.

Progress is dependent upon getting together. It is accomplished by union, not dis-union, by harmony, rather than discord, by the bondage of service instead of the license of selfishness. The forward step is always the result of giving, the surrender of self.

The co-operative union of oxygen and hydrogen creates a compound with serviceable properties originally possessed by neither element. Creation is impossible without union. When men unite, new ideas and a crowd-spirit are created for world-service and differing from any individual idea or spirit. Service is the flower of co-operation, progress the fruit.

Nature demonstrates with insistent repetition that new power for service and progress is never created by competition nor selfishness. Progress moves in a spiral of ever-increasing radius and results from sympathetic union, mutual service and hope. So let us continue to co-operate, continue to serve and continue to hope.

Experience has recently demonstrated the wisdom of indeterminate franchises for all public utilities. The success which this plan has given in the operation and control of street railways induced Wisconsin and Indiana to adopt its provisions and other public service commissions would do well to follow this precedent.

The Indeterminate Franchise

The indeterminate franchise or permit of today differs somewhat from the original plan from which it has been evolved. Beginning as a tenure granted during good behavior it was soon found that some provision should be made for caring for the investment in order to induce capital to assume the risks involved. This was accomplished by giving the city, state or federal government the opportunity to buy the property should the franchise be revoked. This not only provides proper governmental control but also protects capital which is invested in good faith in the public service.

Under the Wisconsin provisions the life of every franchise is thus guaranteed until a municipality shall purchase the utility at a valuation to be fixed by the state commission. Furthermore cities cannot construct competing utilities without the consent of the commission. It is now believed that an additional provision should be incorporated in the law which will make obligatory the taking over of the entire property when the franchise is terminated, as otherwise a distributing system or street railway might be claimed and generating plants left without a market.

The same idea is involved in the permits granted to hydroelectric companies by the federal government. Several municipalities, notably Chicago, have found this plan successful in improving traction affairs. Long term or perpetual franchises make regulation

difficult, whereas short term franchises restrict the industry so closely that it cannot grow to meet the needs of the community. The indeterminate franchise, however, protects the interests of the public and provides sufficient stimulation for private initiative.

The manifest fairness of this provision for ultimate public ownership without confiscation suggests the propriety of its adoption in these Western states. In California it would merely involve an extension of the commission's power of approval of the terms of sale while in other Western states the present acts must be enlarged. This is a subject which every central station should explain to its legislative representative.

Nations, like individuals are seldom self-sufficient. The interdependence of nations has been demonstrated by the European war. The sudden cutting-off of the supply of many products again forces necessity into the maternalistic role of the inventor, and this country is finding at its very doors materials which it has been wont to bring thousands of miles.

The present period of de-centralization is characterized by a tendency to develop latent natural resources. Particularly is this true in these Western states, which have long been dependent for finished products upon Eastern sources of supply.

It seems the height of economic waste to ship copper matte from Western smelters to the Atlantic seaboard for refining and fabrication into electrical apparatus used on the Pacific Coast. Iron, also might well be refined and cast on the Pacific Coast, especially as vast deposits are available in China. Even today there is a pressing need for Pacific Coast lamp factories, for which ample raw materials and a ready market are available.

It is no idle dream which sees the West one of the great manufacturing centers of the United States within the next twenty years. Already small plants are springing up in communities where cheap power, abundant raw materials and good transit facilities are available.

The supplying of local needs for fertilizers, lamp carbons, glass, wood products and the other products whose manufacture has been but recently undertaken, is only the beginning. South America, particularly, is now looking to this country for commercial co-operation. Bolivia, especially, is anxious to export tin and receive our goods in return.

After proper banking connections have been established, the first essential is to buy these foreign products, which is necessary to establish credit and exchange. This country is rapidly approaching the time when it must import rather than export raw materials. This is a field worthy of careful study by the great electric power companies of this territory, whose future prosperity is dependent upon an industrial population.

Our Industrial Opportunities

PERSONALS

C. P. Platt, a telephone inventor from Chicago, Ill., is a recent visitor at San Francisco.

Wm. M. Strong, hydroelectric engineer of Denver, is a recent business visitor at San Francisco.

J. W. Aberender has been appointed secretary of the Oregon Electrical Contractors' Association at Portland.

J. A. Cranston, manager Portland office of the General Electric Company, spent the past week in San Francisco.

J. H. Siegfried, superintendent of power for the Pacific Power & Light Company of Portland, is visiting Eastern cities.

C. F. Conn, assistant manager San Francisco office J. G. White Engineering Corporation, has recently returned from the East.

L. R. Jorgensen, engineer with F. G. Baum & Co., of San Francisco, has recently returned from a business trip in Arizona.

F. G. Baum, consulting engineer at San Francisco, has recently moved his offices from the Chronicle Building to the Hobart Building.

F. E. Newberry of the F. E. Newberry Company is spending a couple of weeks in San Francisco, having recently arrived on the Coast from the East.

H. L. Blecker, superintendent of the Washington Water Power Company, Spokane, Wash., who was in Seattle on business, has returned to Spokane.

H. V. Carter, president Pacific States Electric Company, San Francisco, returned the first of the week from a business trip to Portland and the Northwest.

W. H. Whiteside, president Stevens-Duryea Company, formerly president Allis-Chalmers Manufacturing Company, is a recent business visitor at San Francisco.

A. J. Myers, Pacific Coast manager Wagner Electric Manufacturing Company, will return from an extended business trip throughout the Southwest next week.

E. C. Fellows, motor specialist, at the Seattle office of the General Electric Company, has returned from an extensive hunting trip in Western Washington.

R. J. Davis, Western manager Century Electric Company of St. Louis, has returned to San Francisco from his trip East, where he visited the company's factories at St. Louis.

G. H. Wheeler, manufacturers' agent San Francisco, has succeeded W. S. Heger as representative of the Edge Moor Iron Company, manufacturers of the Edge Moor boilers.

G. McClellan, formerly agent for the Pacific Power & Light Company at White Bluffs, has succeeded C. E. McNeil, resigned, as local manager at White Salmon, Washington.

H. A. Lardner, vice-president of J. G. White Engineering Corporation, has returned to San Francisco from a short trip to Los Angeles. He is expecting to leave for the East soon.

A. S. Grenier, vice-president of the American Power & Light Company, recently made an inspection of the Pacific Power & Light Company's properties in Oregon and Washington.

J. A. Delaney, Seattle, Wash., has invented an electric governor and automatic stop for machinery, steam, gas or electrical, which the inventor claims can be attached to automobiles.

W. S. Heger, Western director Busch-Sulzer Bros. Diesel Engine Company of St. Louis, is making a business trip throughout the Northwest, and **W. S. Heger Jr.** is traveling throughout Arizona.

J. E. Wickstrom, hydraulic engineer, Seattle, has just completed the reconstruction of the electric light plant, the building of a substation and the installation of head gates

for the lighting system at Gold Bar, Washington. He is at present engaged in extending a high power transmission line across the Columbia River below Wenatchee, Washington, for a water consumers' association.

Paul H. Affolter, manager electrical department, Fairbanks, Morse & Co., of San Francisco, underwent an operation on his neck at a hospital in Berkeley and is doing nicely. He expects to be back in his office in about a week.

J. Harry Pieper, engineer illumination and vehicles for the Southern California Edison Company, has been elected chairman of the Jovian Electrical League at Los Angeles. **H. F. Anderson**, division superintendent of plant for the Pacific Tel. and Tel. Company, is vice-president, and **J. O. Case** of the General Electric Company, secretary and treasurer. The other directors are **H. W. Allen** of the Holabird-Reynolds Electric Company, and **J. E. Wilson**, electrical dealer.

J. C. Martin of the Pacific Power & Light Company, **L. T. Merwin** of the Northwestern Electric Company, **H. R. Wakeman** of the Portland Railway, Light & Power Company, **G. E. Quinan** of the Puget Sound Traction, Light & Power Company, **E. G. Robinson**, Jim Creek Water, Light & Power Company, and **J. B. Fisk**, Washington Water Power Company, have been appointed members of the committee on Overhead Line Construction of the Northwest Electric Light & Power Association, by President O. B. Coldwell.

Clark Baker, field representative Mazda Bureau of the General Electric Company, and **F. J. Blaschke**, who is in charge of the publicity and exhibits of the same department, returned from Santa Rosa, where they established a Mazda week. All the electric stores decorated their show windows for the occasion, which added greatly to the success. Mr. Blaschke leaves on a business trip for the East October 24th, to be gone about three weeks. Mr. Baker is at Bakersfield, where he intends to establish a Mazda week from October 26th to November 2nd.

S. Z. Mitchell, president of the Electric Bond & Share Company of New York, one of the leading authorities of the country on electrical securities, was at Boise, Idaho, recently renewing acquaintances made in Boise in the early days. Mr. Mitchell built the first light plant in Boise in 1887. He also constructed the plants in Pocatello, Hailey, Caldwell, Union, Oregon, La Grande, Baker City, Portland, Tacoma, Wash., Seattle, Spokane, The Dalles, Vancouver, B. C., Victoria, B. C., and many others in the Northwest. He is now engaged in financing electric properties, especially in the Northwest. He will probably make a trip of inspection over the lines of the Pacific Power & Light Company when he reaches Portland later in October.

MEETING NOTICES.

Jovian Electrical League of Southern California.

The weekly luncheon of the League, held at Christopher's on Wednesday, October 14th, was attended by over 100 Jovians and a number of visitors. The meeting was in charge of O. L. Howard, who had secured, through the Pacific Electric Railway Company, a splendid universal program. The secretary read his annual report and a nominating committee was appointed by Statesman Colkitt, consisting of J. G. Pomeroy, R. G. Perle, N. W. Graham, E. R. Northmore and A. G. Drake. An interesting lecture was delivered by Rev. Frederick W. Carstens entitled "Does Europe's Day of Extremity Create America's Day of Opportunity?" The speaker, while greatly deploring the terrible ravages and consequences of war, could not fail to see the beneficent moral effects resulting from the struggle in the raising of the standards of the world's ideals. He urged upon his hearers the necessity and opportunity of supplying to the warring nations not only merchandise and produce, but ideas and ideals as well. He desired them all to take a vital interest in the moral as well as commercial opportunities.

INTERNATIONAL ENGINEERING CONGRESS.**San Francisco, September 20-25, 1915.**

Since the development of the war situation in Europe the committee of management for the International Engineering Congress has given serious thought to the question of the modifications which may become necessary in the plans for papers and publications of the transactions.

The total number of papers contemplated was about 290. Of this number about 220 are either definitely promised or well assured, among which are included contributions from England, Spain, Sweden, Holland, Canada, India, Italy, China, Japan, Australia, and various South American countries. The remainder, apportioned chiefly among the nations in the present European war zone, are uncertain, and it must be expected that some portion of them will not be secured.

It is believed, however, that by substituting for these papers certain others which have been offered, and by taking advantage of other conditions which may yet arise, the general plans of the Congress may be carried out with a minimum of change.

Timely notice will be given regarding any such changes in detail, should they become necessary.

In the circumstances which have developed as a result of the European war, the committee is more than ever in need of strong and immediate support from American engineers, who are urged to subscribe promptly, and help to prove that American engineers can carry to successful issue an International Engineering Congress in spite of the war situation abroad.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The San Diego Gas & Electric Company, operating over about 600 miles of territory in San Diego county, has filed an application with the commission to issue \$500,000 face value of 6 per cent debenture bonds to be used in discharging indebtedness.

The Escondido Utilities Company, operating a gas and electric system in San Diego county, has filed an application with the commission to determine the validity of a \$16,000 promissory note in favor of W. S. Sheperdson, and \$32,000 of bonds pledged as security for the note—the note having been executed and the bonds pledged without securing the consent of the commission.

The commission has issued a supplemental order authorizing the San Joaquin Light & Power Corporation to issue a one year promissory note in the sum of \$10,000 to the Bank of Central California. The note is to bear interest at the rate of 7 per cent per annum.

The commission has issued an order authorizing the Fresno Interurban Railway Company to issue \$12,000 of stock and \$24,000 of bonds—being a part of 600 shares of common stock and \$120,000 first mortgage bonds previously passed upon by the commission.

The commission has rendered a decision authorizing the Pacific Power Company, which operates a hydroelectric plant on Mill Creek, Mono county, to issue promissory notes of the face value of \$76,000 in lieu of other notes previously issued without the consent of the commission.

The commission has rendered a decision authorizing the Western States Gas & Electric Company to issue \$731,000 3 year 6 per cent promissory notes at a price not less than 92½ per cent of their face value, plus accrued interest. The proceeds from the sale of these notes will be used by the company to discharge floating indebtedness and open accounts in the sum of \$135,000.

The commission has rendered a decision authorizing the San Diego Electric Railway Company to execute a trust deed to the Union Trust Company of San Francisco, securing a possible maximum issue of \$10,000,000 general first lien sinking fund gold bonds, bearing interest at the rate of 5 per cent per annum. The company is given authority to issue

\$4,497,000 face value of these bonds at the present time, to be used in refunding outstanding bonds and other indebtedness; to return the sum of \$302,438.26 to income, and to defray the expense of making necessary additions and betterments to the property. The commission's order provides that the bonds shall be sold so as to net not less than 85 per cent of their face value together with accrued interest.

The commission has rendered a decision authorizing the Humboldt Transit Company, which operates a street railway in the city of Eureka, Humboldt county, to issue and pledge \$50,000 of its first mortgage 5 per cent bonds with the Pacific Coast Casualty Company as collateral security for a surety bond.

The commission has rendered a decision denying the application of the Southern Pacific Company to raise the transbay commutation rates between San Francisco and Oakland, Berkeley, Alameda and other Alameda county points. At the same time, the commission stated that the Southern Pacific Company should not be compelled to further extend the present 10 cent single fare and \$3 commutation zone.

The Marin County Electric Railways has filed an application with the commission requesting a certificate of public convenience and necessity, authorizing it to construct a street railroad in the town of Sausalito, Marin county, under a franchise granted by the board of trustees of that town. The company also asks permission to issue and sell 150 shares of capital stock, having a par value of \$150,000, with permission to start work on private funds pending the sale of the stock.

The Pacific Gas & Electric Company has filed an application with the commission, requesting authority to renew a promissory note in favor of the National Conduit & Cable Company, in the sum of \$100,000, for a period of 90 days, at 6 per cent per annum.

NEWS OF IDAHO PUBLIC UTILITIES COMMISSION.

The public utilities commission is hearing the complaint of the Marsh Mining Company against the Washington Water Power Company. The case involves a charge of discrimination made by the mining company. The complaint and answer were filed with the commission some time ago, but the attorneys have been unable to get together at any time since until recently, though the case has been set for hearing several times. The Marsh Mining Company has a contract with the power company which recently expired. At that time the mining company refused to renew at the old rate, claiming that it was higher than that charged other companies in the same section. It tendered to the power company the amount it believed to be fair and reasonable, and this proved to be three thousand or four thousand dollars less than the power company asked. The power company then threatened to shut off the power unless the mining company paid the balance and agreed to the rates. The utilities commission, on application from the mining company, asked the power company to continue the service until the case could be heard.

The matter was taken under advisement by the commission, but an early decision is expected because of the urgency of the matter. Rates in the north are not involved and will not be passed upon at that time.

There is a complaint from the Hecla and Federal Mining Companies before the commission at the present time which will determine, on its decision the reasonableness of all power rates in the north, but this has been postponed until the Supreme Court could pass on some phases of the matter. A hearing was had at the last session of the court at Lewiston, and a decision is expected soon which will allow the case before the utilities commission to proceed. A. G. Kerns, attorney, and W. E. Greenough, general manager, both of Wallace, appeared for the mining company, while the power company was represented by its president, D. L. Huntington, and its attorney, F. L. Post, both of Spokane.

DISCUSSION ON RATE THEORIES.

[Continued from page 387.]

Mr. Cotton seemed to think that you could charge for service rendered to the public much the same as one would for drawing a gallon of cider out of a barrel.

The days of flat-rates are going rapidly.

As has been said in your former discussions, a charge has been made for carrying a letter—2c—whether it be carried 2 miles or two thousand miles. Every rate charge made must be a compromise between justice and efficiency. In carrying a letter 90 per cent of the cost is in terminal charges. It doesn't depend upon the distance through which it is carried. The block system of telephone rate in the state of Washington was fixed by the division of the state into ten-mile blocks. The cost of the message should be a certain sum for the first block and a certain additional sum for the next block. When the matter was up before the commission I endeavored to find out if any computation had been made by engineers throughout the country, or by the company, to determine the terminal cost. If the terminal cost of sending a message is 60 per cent of the total cost to send that message, then the rate should be based upon the terminal cost, plus the line-cost.

In the matter of gas rates I came to the conclusion that the absolutely equitable gas rate, insofar as such a thing is possible—would be fixed in this way: a certain fixed charge to cover overhead and consumers' expenses, based upon fair service, then another charge to be made for the service, depending upon the amount of service rendered. We had a report from an expert in the gas business, and the report showed that a proper charge to cover overhead expenses would be 15 cents a meter-light. With gas at the rate of 50 cents per thousand feet, the ordinary residential consumer, having a 5-light meter, would pay 75c a month. After that his rate would be dependent upon the cost and distribution of the product. If he consumed only 200 or 300 ft. of gas, he would pay 75 cents, plus 50 cents, or \$1.25 per month for the first 1000 ft. of gas—simply prohibitory for the small consumer.

That is where the proposition of expediency as against justice comes in. I believe practically every consumer who uses less than the minimum instead of more than the minimum is exceptional.

In a compromise we must make the large consumer pay part of what we render to the small consumer. I believe that principle will always be recognized in the fixing of rates.

A merchant in this city asked me the other day if I had anything to do with the reduction of rates by the Washington Water Power Company. I said yes, swelling out my chest. He replied, "I thought so." Last month my house bill was 30 cents less than the previous month, and my store bill was \$25 more. My hope and wish in the business of fixing rates for electric light companies is that the rates should be as low as possible. I am just a citizen and taxpayer. The rates should be as low as they can reasonably be made and render an equitable return on the company's investment.

The rates should also be as simple as possible—that is the rate-making on the bills. When you commence to figure in all the data on those bills an electrical engineer could not make out your bill for you. Something in accuracy should be sacrificed to simplicity. If we yield something to compromise, wouldn't it be wise to yield just a little bit more? Have the bills so simple that men may know how to figure their own bills and find the same total as you do when computing it.

I believe that the public service commission in the various states should always have in mind the cost of the plant, the actual money invested, the risks involved, the lean years, and that the return should be full and equitable to the men who have furnished the money and brains to

build up these plants. I believe public service commissions have a right and a duty to raise rates when they find they are confiscatory. I do not believe the railroads are all going to "hell" as Mr. Cotton showed. He showed how rates had dropped since the regulation of rates had been enforced. Mr. Cotton didn't inform you though that the common stock had been given as a bonus to the holders of it; that it was largely watered-stock. I want to say to you that the amount of dividends paid upon common stock has absolutely and greatly advanced along all these years. Ten years later, under the conditions that existed, there were paid dividends of 7.4 per cent upon railroad stocks outstanding. That doesn't look like confiscation.

H. L. Gray (former chief engineer of the Washington Public Service Commission): I was somewhat impressed by Mr. Fassett's remarks which had a particular bearing on rates. In connection with the rate of residential lighting it was brought out that the power used in supplying residence business is due to certain elements, whereas the power is consumed on an entirely different basis. Practically all the revenue in the residential lighting in small towns is obtained from power on the kw-hr. basis. It is at least not based on consumption by the individual consumer. It is all due to other things—demand, number of consumers, density of population, and distance from the generating plant.

Mr. Osborn spoke of consumption by high efficiency lamps. It seems to me that the rate is to be a combination of meter and flat rate. There is nothing wrong with the kw-hour meter rate. It gives the factor you are looking for and is something tangible the consumer can grasp. But it seems to me that there must be taken into consideration the service rendered.

In a commission appointed by the National Rate Association they stated that a rate should be determined by the value of the service rendered. It looks like the regular rate is to be a combination of flat and meter rate. Sell power on candle rates.

One question I have heard raised frequently of late is: Why is the kw-hr. rate higher in some small towns than in a large city? I have heard it raised a great many times by commissions. My answer is brief: "The rate per kw-hr. charged in a small town remote from the generating station must be greater than that charged in a large city, for the following reasons:

1. In large cities, both the system load factors and the class load factors are higher than in the case of small towns. In other words a greater number of kw-hr. per kilowatt of system demand are sold in the larger cities. This is due to the higher load factor of each class of service, and to the diversified use of power in large cities, which tends to increase the consumption without increasing the maximum demand, the demand being the controlling element of the cost of production and distribution.

2. All other things being equal, a city remote from a generating plant must pay a higher rate per kilowatt hour for power consumed, than a city nearer the generating plant, due to the greater investment to serve the former. This should require no further comment.

3. Owing to the lower load factor and lack of diversity in a small town, together with the smaller consumption, the general and managerial expenses of such a town are almost always greater per unit of consumption than in the case of a large city.

4. Again, owing to the low consumption in the small town, the cost of maintenance is frequently greater per unit of consumption than in a large city, owing to the more permanent construction in the latter.

5. In large cities, the consumption per dollar invested in the distribution system is generally greater than in small towns. This will, of course, increase the fixed charges on the distribution system, which will increase the necessary kw-hr. charges.

SUGGESTIONS FOR ESTIMATING SHEET, Alameda County Electrical Development League.

Owner	Date
Contractor	Location
Architect	Address

	Outlet.	S. P. Sw.	3 Way.	Base P.	Iron P.	Lts.	Cir.	Bells.	Tel.
Basement									
First floor									
Second floor									
Attic									
Total									

Quantity.	Article.	Cost.	Quantity.	Article.	Cost.
.....	Inspection .....	.....	.....	Single Plates .....	.....
.....	Conduit .....	.....	.....	2 Gang Plates .....	.....
.....	Condulets .....	.....	.....	3 Gang Plates .....	.....
.....	Condulets .....	.....	.....	4 Gang Plates .....	.....
.....	Service Box .....	.....	.....	S. P. Flush Sw. ....	.....
.....	Ground Clamps .....	.....	.....	3 Way Flush Sw. ....	.....
.....	Ground Wire .....	.....	.....	S. P. Snap Sw. ....	.....
.....	Feed Wire .....	.....	.....	3 Way Snap Sw. ....	.....
.....	Service Switch .....	.....	.....	Base Plugs (Con.) ..	.....
.....	Cutouts .....	.....	.....	Iron Plugs (Con.) ..	.....
.....	Cutouts .....	.....	.....	Bells .....	.....
.....	Cutouts .....	.....	.....	Buzzers .....	.....
.....	Asbestos .....	.....	.....	Batteries .....	.....
.....	Cabinet Bob .....	.....	.....	Bell Transformer ..	.....
.....	Fuses .....	.....	.....	Push Buttons .....	.....
.....	Fuses .....	.....	.....	Floor Push .....	.....
.....	Sub. Feed Wire .....	.....	.....	Table Clamp .....	.....
.....	Sub. Feed Wire .....	.....	.....	Bell Cord .....	.....
.....	No. 14 R. C. ....	.....	.....	Bell Wire .....	.....
.....	No. 12 R. C. ....	.....	.....	Tel. Wire .....	.....
.....	No. 10 R. C. ....	.....	.....	Speaking Tube .....	.....
.....	No. 8 R. C. ....	.....	.....	Speaking Tube Whistle ..	.....
.....	2/8 in. Loom .....	.....	.....	Speaking Tube Mouth Piece ..	.....
.....	1/4 in. Loom .....	.....	.....	Speaking Tube, Elbows ..	.....
.....	3/8 in. Loom .....	.....	.....	Tape, Solder, Paint ..	.....
.....	3 in. Bushings .....	.....	.....	Pipe Straps, etc. ....	.....
.....	4 in. Bushings .....	.....	.....
.....	5 in. Bushings .....	.....	.....
.....	6 in. Bushings .....	.....	.....
.....	No. 5 1/2 Solid Knobs ..	.....	.....
.....	No. 5 1/2 Split Knobs ..	.....	.....
.....	Outlet Boxes .....	.....	.....
.....	Outlet Plates .....	.....	.....
.....	Gas Clamps .....	.....	.....
.....	Loom Clamps .....	.....	.....
.....	Single Sw. Boxes .....	.....	.....
.....	2 Gang Sw. Boxes .....	.....	.....	Cartage .....	.....
.....	3 Gang Sw. Boxes .....	.....	.....	Labor .....	.....
.....	4 gang Sw. Boxes .....	.....	.....	Car Fare .....	.....
.....	Spacers .....	.....	.....
				Total Cost .....	.....
				Gross Profit .....	.....
				Bid Price .....	.....

NEW CATALOGUES.

The General Electric Company has just issued an interesting bulletin, No. 48014, on Mine Hoist Equipments. The bulletin is profusely illustrated, takes up the question of economy of electric drive, and treats of the general subject of underground hoists, their operation and control. Bulletin No. 46390 describes Direct Current Test Meter, known as Type CE-5 showing the construction of the meter in detail, and containing diagrams of connections. Bulletin No. 42800 contains a reprint of an article appearing in the General Electric Review, and devoted to the use of electrically driven air compressors in foundries.

Bulletins Nos. 4500, 4510, 4520 and 4530 describe the new Cutler-Hammer line of automatic machine tool controllers for use with shunt or compound-wound d.c. motors, adapted for constant or adjustable speed work, with or without interpoles. Bulletin 4510 describes automatic machine tool controllers of the plain starting type; Bulletin No. 4520, those of the speed setting type, and Bulletin No. 4530, those of the speed regulating type. Bulletin No. 6753 describes double-pole diaphragm regulators for d.c. and a.c. motors; Bulletin No. 7131, full magnetic controllers; Bulletin 9125, secondary resistance starting rheostats for polyphase slip ring motors; Bulletin

9130, multiple-switch starters; Bulletin No. 9135, drum type starters; Bulletin 9155, drum reverse switches; Bulletin No. 9320, panel type speed regulators; Bulletin No. 9350, drum reversible crane controller; Bulletin No. 9355, hoist controllers; Bulletin No. 9359, rope operated drum reverse switch; Bulletins Nos. 9360 and 9365, speed regulators.

PUBLICATIONS RECEIVED.

Of the several central station "house organs" which are received at this office, "Current News," from the Philadelphia Electric Company, N. E. L. A. Section, furnishes an example of what such a publication can do. The September issue is a commercial number. Beautiful cuts, paper and printing, well-edited departments and material of personal interest to each company employee are found in the 88 pages which make up this monthly publication. Wisely recognizing the folly of compelling advertising from the firms on the purchasing agent's list, the management makes no effort to masquerade under any false pretense. The Union Electric Bulletin, from St. Louis; Current Topics, from the Southern California Edison Company of Los Angeles; the Pacific Power and Light Company Bulletin, and the Edison Magazine, from the New York Edison Company, also follow this practice.



INDUSTRIAL

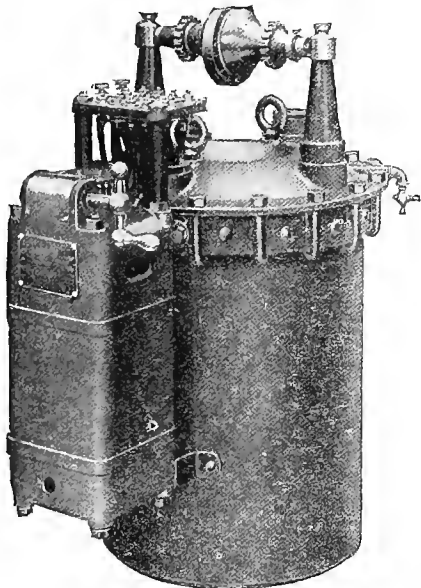


NEW OIL TESTING SET.

With high voltage oil insulated apparatus, in order to insure successful operation, it is necessary to maintain the dielectric strength of the oil at maximum value. A testing set has recently been developed and placed on the market by the General Electric Company for determining the dielectric strength of oil.

This set consists of a testing transformer with an induction regulator for voltage control and an oil spark gap. All of the various parts are assembled and mounted so as to form one complete unit, which is compact and neat in appearance and, at the same time, may be conveniently and quickly operated. The set is built for both 25 and 60 cycles.

The transformer has a rating of 3 k.v.a. at 30,000 volts, but may be operated at 10 per cent above this figure. The high voltage winding is equipped with a voltmeter coil for indicating directly the test voltage. The transformer tank is of drawn seamless steel and the cover is fitted so as to be oil tight, permitting shipment filled with oil. The induction regulator is specially designed for the testing set and allows a variation of the test voltage from zero to maximum. The regulator, as well as the transformer, is arranged for series-parallel connection, making the set suitable for use on 100 or 200 volt circuits. A dial is attached to the top of the rotor shaft of the regulator and is accurately graduated to give readings of the test voltage directly in kilovolts.

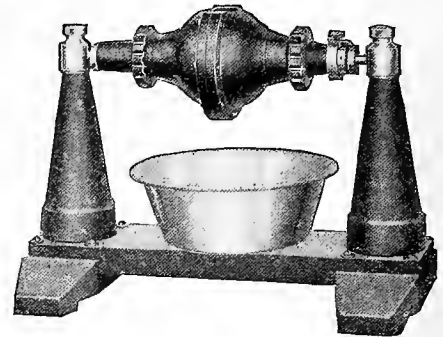


Type M 30,000 Volt Oil Testing Set.

The set may also be equipped with a small portable voltmeter for reading the test voltage, provision being made on all outfits for mounting an instrument specially designed for the set. This instrument is of the dynamometer type, is very accurate and the scale is graduated to read the test voltage in kilovolts.

The oil is tested between flat metal discs, which are located inside the receptacle. One electrode is stationary, and the other has a micrometer adjustment with an adjustable zero index. This permits taking up readily any wear in the gap. The receptacle is designed so that it may be very conveniently cleaned. Care has been taken that the quantity of oil required for tests is as small as is consistent with good results. It is estimated that three-quarters of a quart of oil is sufficient for one sample, allowing five tests on clean oil.

The oil receptacle and spark gap are supported by the high voltage terminals of the transformer. By merely turning the receptacle about its horizontal axis, the oil which has been tested may be emptied, being caught by a depression in the transformer cover and flowing away through a pipe.



Oil Spark Gap Mounted as a Separate Unit.

The receptacle and gap may also be easily removed from the supports, leaving the transformer free for high potential testing of any kind up to 33,000 volts.

This apparatus is also equipped with a small sensitive circuit breaker of novel design, which is attached to the side of the regulator and is likewise specially designed for the apparatus, the set may also be mounted on a truck, making it portable.

The outfit is complete in every essential detail, being all assembled in one unit, which makes it compact and convenient to operate and easy to obtain quick and accurate results. The use of the induction regulator for voltage control produces no noticeable distortion of the e.m.f. wave shape and therefore contributes considerably to the accuracy of the test results.

The weight of the 60 cycle set complete is 465 lbs., height 30 in., length 24 in., width 17½ in.; the weight of the 25 cycle set complete is 670 lbs., height 32 in., length 26½ in., width 20½ in.

TORQUE COMPENSATORS.

The Westinghouse Electric & Manufacturing Company has introduced a new device known as a torque compensator, intended primarily for modifying the time element characteristics of an alternating current overload relay. It reduces the torque of the relay at heavy overloads without reducing the torque at light loads. It thus increases the time element of the relay at overloads, its effect being in proportion to the overload.

The overload relay with definite minimum time element obtained by a torque compensator provides selective action of circuit breakers where feeders are placed in series. The relays controlling breakers nearest the source of power can be set for slightly greater time element than those further along. The difference in time is retained at all overloads with sufficient accuracy to cause the breakers nearest the trouble to open thus confining the inoperative section to the smallest area, without interruption of service on part of the system between the trouble section and the source of power.

Another use of the relay with definite minimum time element is in relieving circuit breakers. It is well known that the ultimate breaking capacity of a circuit breaker depends on the time of breaking. If a ground or short circuit can persist for two seconds before the circuit is opened, the ultimate breaking capacity is greatly increased; that is, the strain on the breaker is reduced very materially,

owing to the drop in voltage and current occurring during the interval.

The torque compensator consists essentially of a small auto-transformer connection between the relay and the current transformer on the line. It is so designed that at a certain value of current, the core of the compensator becomes saturated, and any further rise in current results in an increasing impedance drop so that the current in the relay circuit does not increase in proportion to the current in the line.

The ordinary time adjustment provided on standard relays will give the desired definite minimum time element within the range characteristics to each relay. In the Westinghouse relay this range is from 0 to 2 seconds.

The winding and core are enclosed in a neat box with sides perforated for ventilation. The compensator can be mounted on any convenient place, such as the rear of a switchboard behind the relay it controls.

NEW ENCLOSED REVERSING SWITCHES FOR HIGH TORQUE SQUIRREL CAGE MOTORS.

The enclosed drum type reverse switches recently developed by the Cutler-Hammer Manufacturing Company of Milwaukee are designed for the reversing of small polyphase



Hand Type and Rope-Operated Type of Reversing Switch for Squirrel Cage Motors.

induction motors that may be thrown across the line in starting. As shown in the accompanying illustrations provision is made for operating by means of a rotary handle or by means of ropes. In the latter case the drum switch may be installed out of reach, and in a position the reverse of that shown. These switches are also adapted for use on small a.c. elevator equipments driven by high resistance rotor squirrel cage motors. The enclosing case protects the switch contacts from dust and dirt, and prevents accidental contact of the live parts by the operator or workman.

THE MIRRORLITE.

The Mirrorlite is a new and unique development in portable lamp, consisting of a portable mirror, a metal reflector, a lamp socket, a silk cord and an attachment plug. The socket is mounted directly on the base by means of a hinge joint which permits the adjustment of the lamp and reflector through a wide range of angles. The mirror, six inches in diameter, is supported by three clips, flush with the opening of the reflector. The mirror is surrounded by an open space of one inch through which the light is diffused. The Mirrorlite was originally designed for the man who shaves himself. With one adjustment it illuminates all parts of the face—under the chin and both cheeks. However, after the clips have been released and the mirror removed, advantage can be taken of its adjustable features by using it on the sewing machine, the piano and the writing desk. A plug on the base provides for hanging it on the wall. The unit is manufactured by the Holophane Works of General Electric Company.

WESTINGHOUSE LITERATURE FOR A. E. R. A. CONVENTION.

The Westinghouse Electric & Manufacturing Company has issued quite an elaborate lot of literature in connection with the A. E. R. A. Convention to be held at Atlantic City, October 12th to 16th, consisting of the following publications:

Railway Date Exchange No. 10 contains a considerable amount of data pertaining to the operation of street railways, dealing more particularly with the following subjects: improvement of voltage on interurban lines, effect of voltage on performance of motors, cost of stops and trailer operation, saving energy, train operation in city and interurban service, as well as a number of other equally important subjects in the treatment of which considerable valuable data is given.

Heavy Traffic Centers, Circular 1549, shows a large number of handsome engravings illustrating the heavy traffic centers in various large cities throughout the country where surface lines are equipped with Westinghouse apparatus.

1500-volt Direct Current Substation Equipments, No. 1550, as its title indicates, deals with this class of apparatus. Descriptions of a number of different roads throughout the country which are using this type of equipment are given, a number of which are profusely illustrated. Maps are also given of these properties showing the territory covered, and considerable operating data is also included. Switchboards

and accessories for use on 1500-volt direct current lines are also illustrated and described.

Train Operation for City, Suburban and Interurban Service, No. 1546, is a collection of illustrations with brief notes showing the advantage to be derived from the use of multiple unit trains. This book is also well illustrated with views of a number of properties in all parts of the country which make use of the multiple unit train equipped with Westinghouse apparatus.

Among the interesting features are some curves showing the small amount of current required for a high-speed interurban car when handled in a careful manner.

Following its usual custom, the Westinghouse Company has this year issued a Progress Leaflet (No. 1553), in which is outlined the progress made by the company in electric railway apparatus. Among the items included this year are the Philadelphia Terminal electrification of the Pennsylvania Railroad; the electrification of the Norfolk & Western Railway Company of the Bluefield Division in Virginia; the recent addition to the New York, New Haven & Hartford road and a large number of other steam railroad electrifications, and city surface, elevated and subway lines both at home and abroad.

The Westinghouse Exhibit at the A. E. R. A. Convention is attractively described in Circular 1551, with an art cover, representing the well-known "Joe and the General Manager" leaving for Atlantic City. This scheme is followed throughout the book in which Joe and the General Manager discuss the various pieces of apparatus in the Westinghouse Exhibit.



NEWS NOTES



INCORPORATIONS.

SAN FRANCISCO, CAL.—A dispatch from Albany announces the incorporation of the Mt. Whitney Power & Electric Corporation of New York with a capital stock of \$4,800,000. The directors are Harris Hammond, R. D. Hanna, T. T. Trapnell, all of New York, and Charles R. Blyth of this city. The announced purpose of the new corporation is to take over the stock of the Mount Whitney Power & Electric Company of California. No reason is given for this change. Some time ago it was announced that the Mount Whitney Company would issue \$500,000 preferred stock, the proceeds to be used in taking up floating debt. There being no general market for the stock at a price which would be allowed by the commission, it was purchased by John Hays Hammond, the principal holder of the common stock. It is probable that the reincorporation in New York means that the new company will issue the preferred stock after acquiring all the common stock of the operating company.

FINANCIAL.

SAN FRANCISCO, CAL.—Chairmen and secretaries of the protective committees of the different classes of holders of the Northern Electric securities have been chosen by the committees as follows: Unsecured creditors committee—A. M. Irwin, chairman; A. L. Reed of Suisun, vice-chairman; Benj. Upham, secretary; Northern Electric committee—Vanderlynn Stow, chairman; Phillip I. Manson, vice-chairman and secretary; Northern Electric Railway committee—Judge M. H. Hyland, chairman; Carl Raiss, secretary.

NORTH YAKIMA, WASH.—Judgment for \$346,025 in favor of the Dexter-Horton Bank and for \$497,945 in favor of the American Power & Light Company, has been given against the Hanford Irrigation & Power Company in a decree filed in the United States Court. The claim of the banks as trustee for the bondholders is given priority. Sale of the Hanford Company's lands, pumping site, irrigation canals and other property is ordered to be made by the receiver after published notice, \$380,000 being named as the upset price. The property will pass free of all claims, except that it is subject to the existing rights of water users holding contracts from the Hanford company.

LOS ANGELES, CAL.—The Midway Gas Company has announced a plan of reorganization that will, its sponsors believe, lift the property out of difficulties. The company has outstanding \$1,500,000 6 per cent serial bonds due as follows: \$60,000, December 1, 1913; \$90,000, 1914; \$120,000, 1915; \$150,000, 1916; \$180,000, 1917 to 1922 inclusive. The first maturities have been retired, having been purchased by stockholders, but there is no prospect that the next maturities could be redeemed. The reorganization plan provides for the issuance of a similar amount of 15 year 6 per cent bonds secured by first mortgage on the entire property. It is provided that all earnings after operating expenses, taxes, interest and preferred dividend shall be paid into a fund for the redemption of the outstanding bonds in the same order that they would be retired under the present organization. The new bonds changed for the shortest maturity of old bonds will be redeemed first from the fund to be accumulated for that purpose, the difference between the two plans being that the company gives no guarantee of redemption at any fixed period of 15 years. The reorganization committee which has been asked to act is composed of C. Pierce, Ferdinand Reis Jr., S. Waldo Coleman, W. G. Kerckhoff and H. R. Tobey. Jared How has been retained as counsel to the committee.

SAN FRANCISCO, CAL.—B. H. Dibblee, vice-president and Pacific Coast manager of E. H. Rollins & Sons, says that the proposed Northern Electric Railway Company reorganization is unfair to the first mortgage bondholders. "This plan, in that it contemplates taking care of the junior creditors and the present stockholders, ignores the prior right of the first mortgage bondholders to be paid back their money or take the property covered by their bonds before the junior creditors receive any consideration. My firm has absolutely no interest in this property and has never sold a dollar's worth of its securities to its customers, but I believe the time has almost arrived when some concerted action should be taken by bond houses in San Francisco to prevent reorganizations being put through in the interests of junior creditors and at the expense of bondholders. The Northern Electric first mortgage bondholders in this case can demand their rights, and, if their bonds are a legal first mortgage on the principal part of the property of the company, enforce their prior lien, if they so desire; and I sincerely hope they will do so. If they do, I believe they can ultimately get their money back. Unless there is a legal complication, I can see no legal reason for the first mortgage bondholders to surrender the equity in the property to the junior creditors and present stockholders, for no consideration whatever, than there would be for any one, in foreclosing a mortgage on a piece of real estate, to surrender the title representing the equity to the original owner. The proper way for the junior creditors to protect their interests would be to purchase the property themselves at foreclosure sale for a sufficient sum to satisfy the first mortgage bondholders; or to offer a valuable consideration to the first mortgage bondholders for the privilege of retaining an interest in the reorganized company. From my knowledge of the policy of the railroad commission of the state of California, which would ultimately have to authorize the issuance of all new securities in case of a reorganization of this property, I do not believe they would authorize any securities under the reorganization plan as suggested."

ILLUMINATION.

SEQUIM, WASH.—The council has granted an electric light and power franchise to J. L. Keeler.

GILROY, CAL.—The matter of selling the city electric light plant and franchise is under consideration by the council.

CATHALMET, WASH.—A bond issue of \$4200 has been voted for the purpose of installing a municipal electric lighting plant.

WINNEMUCCA, NEV.—W. J. Compton and Frank L. Reber have applied for a 25 year franchise to operate a gas plant here.

TACOMA, WASH.—The council has authorized Superintendent Collins of the city light department to purchase \$20,000 worth of incandescent lamps.

PORTLAND, ORE.—The East Side Business Men's Club met recently to receive reports for the committee on the cost of lighting Grand avenue by gas and electricity.

SAN DIEGO, CAL.—A protest against the proposed ornamental lighting system on Fifth avenue from A to Laurel has been filed with the council. The cost is said to be excessive.

STOCKTON, CAL.—The Western States Gas & Electric Company plans to install a new street lighting system in Stockton, and to undertake general construction work in the cities of Richmond and Eureka.

MONROVIA, CAL.—The Keystone Iron Works has been awarded the contract for furnishing 60 cast-iron electroliers to be used on Myrtle avenue, between White Oak and Falling Leaf avenues, on its bid of \$6658.

FLORENCE, ARIZ.—R. G. Arthur, general manager of the Florence Improvement Company has announced that his company will not be able to take up the matter of an electric light plant for Florence before December 1st.

WHITTIER, CAL.—President Ferdinand Bain of the Southern Counties Gas Company, which now furnishes artificial gas for Whittier, has made the assertion that the city is to have natural gas supplied by the same company.

MARTINEZ, CAL.—Work will begin immediately on the feeder and pipe lines of the new Contra Costa Gas Company, according to President S. W. Coleman and service will be furnished by the middle of February. The Hooper estate at Pittsburg has been purchased for the main plant site, and it is proposed to furnish Martinez, Concord, Antioch and Pittsburg with gas.

PASADENA, CAL.—Resolutions of intention for the establishment of three ornamental lighting districts will be acted upon by the city commissioners within a short time. The projects that will soon be under way are on El Molino avenue from Colorado street to Woodland road, South Fair Oaks avenue from Dayton to California street, and Bellefontaine street from Fair Oaks avenue to Orange Grove avenue.

LODI, CAL.—The city purchased from the Western States Gas & Electric Company the equipment which is now supplying the Hutchins and Schroeder additions to this city with electricity. These two additions were annexed to the city last April. The Western States will continue to furnish the residents with electric light until the 25th of this month, at which time the city will take over the lines. The purchase price was \$1370.

PORTLAND, ORE.—Additional lighting systems are authorized by the city council as follows: The principal special appropriations allowed were for installing lighting systems in parks. By putting lights in the parks Mayor Albee says he will not have to need as many additional policemen as had been asked for. Special appropriations for lighting apparatus were granted in parks as follows: Holladay Park, \$1140; Kenilworth Park, \$1500; Laurelhurst Park, \$8000.

TRANSMISSION.

MERCED, CAL.—A hydroelectric power plant will soon be constructed at the Mountain King mine in Mariposa county, which will furnish 400 horsepower as compared with 75 horsepower now furnished by the water plant.

SAN FRANCISCO, CAL.—Plans have been completed by the city department of architecture, and turned over to the board of public works, for the central power station which is to be erected in the Civic Center to supply light and power to the various buildings. The building will be erected at the corner of McAllister and Larkin streets and will be of the reinforced concrete type. About \$75,000 is available for construction.

TRANSPORTATION.

FRESNO, CAL.—The Fresno Traction Company has been granted a franchise to construct a double track street railway upon certain streets in this city.

BENICIA, CAL.—A. D. Bowen has been granted the right to construct and operate an electric railroad, single or double track, upon certain streets in this city.

OGDEN, UTAH.—At a meeting of the board of directors of the Ogden Rapid Transit Company this afternoon the general contract for the new interurban passenger station on Twenty-fourth street was awarded to C. F. Dinsmore of Ogden. While the contracts for the electric wiring and heating

have not yet been awarded, General Manager P. D. Kline of the traction company declared today that the total estimated cost of the new station would be \$25,000. The terminal will be erected for the joint use of the local company and the Salt Lake & Ogden Railway Company.

FAIRFIELD, CAL.—To obtain a right of way through Jamison canyon in this county, the California Terminal Railway Company has filed condemnation complaints against Josiah Z. Morrison, M. T. Freitas, Daniel Madigan, James Moore, William Higgins, Melville Dozier and the Vallejo & Northern Railroad Company. The California Terminal Company, one of the latest companies to file articles of incorporation, proposes to build a railroad from San Rafael to Sacramento through Marin, Sonoma, Napa, Solano, Yolo and Sacramento counties. The company was incorporated less than a month ago, and the action in obtaining rights of way indicates early construction of the road.

FRESNO, CAL.—Seven hundred and fifty tons of steel are now en route to Fresno and work on the second unit of the Fresno Interurban Railway Company's line from Fresno avenue to the Normal school will be started the last of this month, providing the franchise be granted by the supervisors by that time. The route to the Normal school will be along Fresno avenue for one quarter of a mile to Mahoney, thence north to Weldon avenue, and out that thoroughfare to the Normal school. Just as soon as the work is completed on the unit to the Normal school construction will be started on the extension of the present line to Clovis. The extension will start from the end of the first unit in Alvina Heights.

DIXON, CAL.—Celebrating the inauguration of passenger and freight service over the Sacramento Valley Electric Railroad Company's railway between Dixon Junction and Dixon, the company carried passengers free last Saturday. The line, which is 12 miles long, is the first unit in a system of 150 miles to be constructed between Rio Vista on the Sacramento River to Red Bluff at the northern end of the Sacramento Valley. The Sacramento Valley Electric Railroad Company is financed by the people along the route of the line. Extension of service from Dixon to Woodland, Willows, Corning, Tehama and Red Bluff will be begun shortly. The new railway has a working agreement with the Oakland, Antioch & Eastern Railway, connecting with the latter at Dixon Junction. The Sacramento Valley road will connect regularly with the main line trains of the Oakland, Antioch & Eastern. The officers of the new company are: George W. Pierce, president; W. N. Woodson, first vice-president; H. W. Manor, second vice-president; H. R. Timms, treasurer; Arthur G. Huston, general counsel; Melville Dozier, Jr., general manager; Louis L. James, auditor.

TELEPHONE AND TELEGRAPH.

NORTH BEND, ORE.—The Coos Bay Telephone Company will install an automatic call system, requiring new telephones and switchboard.

LOS ANGELES, CAL.—That the Home and Pacific States Telephone Companies will resist any effort at consolidation or elimination of either system and thus create a one-phone system, is clearly indicated in the report of ex-Senator Henry E. Carter, secretary of the Wilmington Chamber of Commerce, to that body. The report, which has been adopted by the Wilmington chamber, recommends that no action be taken until the expiration of the Pacific Company's franchise in 1916. The Chamber of Commerce, at Senator Carter's suggestion, has sent a request to the Board of Public Utilities that a franchise to expire when the Pacific franchise shall expire, be granted to the Home company, if any franchise is granted. The Wilmington chamber has withdrawn its opposition to the franchise application of the Home Company, which has been before the utilities body for several weeks.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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VOL. XXXIII No. 18

SAN FRANCISCO, OCTOBER 31, 1914

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BY HOWARD JOSLYN.

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BY W. G. VINCENT, JR.

STANDARDS IN SAN DIEGO.

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STANDARDS FOR GAS SERVICE IN THE WEST.

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October 21, 1914, was Edison Day, in commemoration of the invention of Edison's Electric Lamp.

During the 8 weeks just prior to this date, a great publicity campaign, costing thousands of dollars, told the people of the nation, through talks in over 12,000,000 copies of magazines and periodicals, 3,000,000 back cover advertisements, billboards, hangers, posters, stickers, window displays, slides for motion picture houses, cuts, display and editorial columns of daily and weekly newspapers throughout the land, what Edison Day meant to them.

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Agents say the campaign is the greatest and most complete support given them by an electrical manufacturer for electrical goods.

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SEATTLE'S CENTRAL FIRE ALARM SYSTEM

BY HOWARD JOSLYN.

(An excellent description is here given of Seattle's new automatic fire alarm system, reasons being given for the adoption of special features. Mr. Joslyn is city electrician at Seattle. A more extended account of his experience appears on the personal page in this issue.—The Editor.)



Seattle's Central Fire Alarm Office, Showing Instrument Pedestals and Boards.

The newly completed central fire alarm office of the City of Seattle is an example of what can be accomplished when the designer, in determining what will best answer the requirements, is not hampered by local conditions or old equipment. The principal requirements to be met were reliability, speed of signal transmission and economy of operation and maintenance.

The growth of Seattle in the past fifteen years has been so rapid that the automatic six and twelve circuit repeaters and switchboards purchased between 1898 and 1906 could not, with any reasonable additions, be expected to meet the needs of the service in the near future. The expansion of the city limits and topography of the territory has been such as to readily encourage the use of one or more fire alarm

substations, in which the former automatic apparatus is and will be of advantage.

At present a large district lying north of the Lake Washington Canal is handled by a six circuit automatic office some three miles distant and connected to the main office by a signal circuit. This substation equipment has reached the limit of its capacity, and will soon be replaced by a twelve circuit office of the same type. In a few years the southern district will be of sufficient size to require a substation located about the same distance from the main office in an opposite direction, and the six circuit apparatus will then be used.

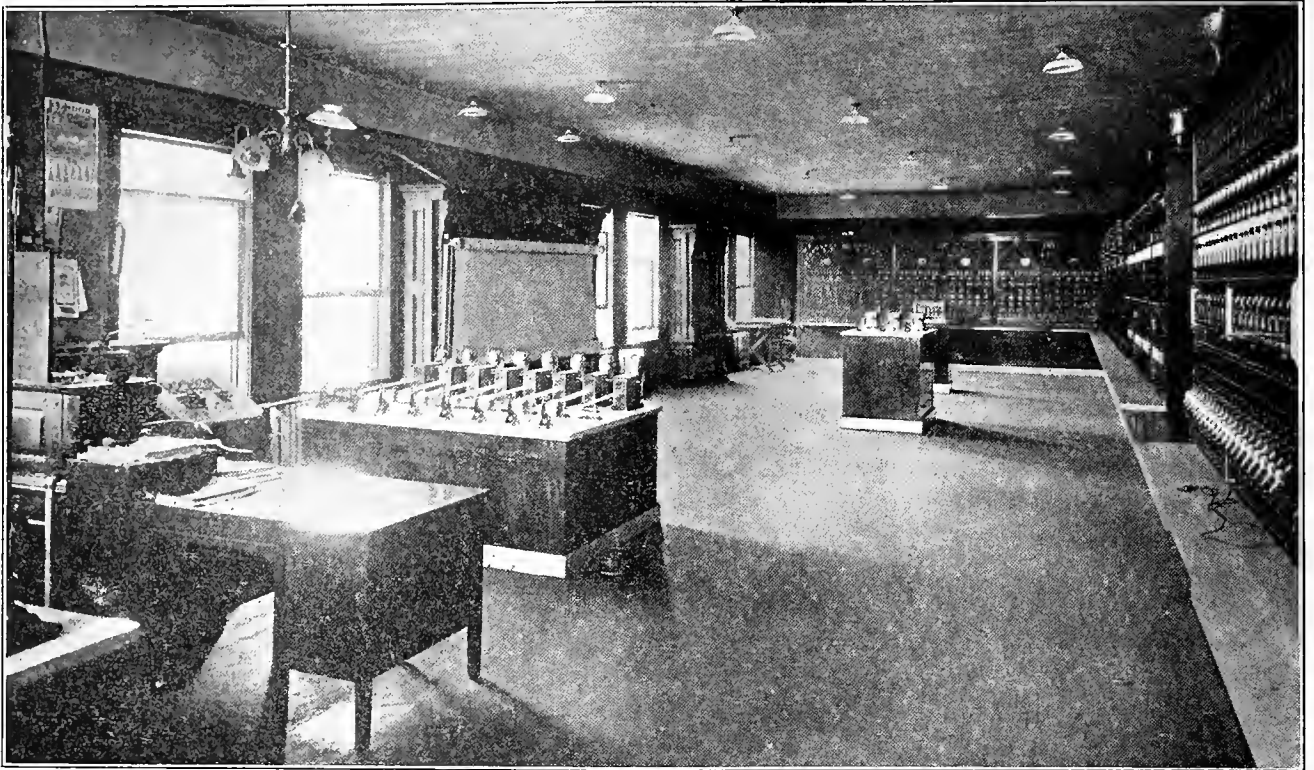
After extended study of central office equipment in other cities and discussion with engineers from the manufacturers of fire alarm apparatus, it was decided

to install a combined manual, semi-automatic and automatic office for forty box, ten joker or register lines and ten gong circuits, with extra switchboard capacity to handle appliances local to the main office. The automatic method of operation was emphasized as the one to be generally used for transmission of incoming box alarms over the joker circuits; and the equipment was required to work with perfect non-interference on signals coming in at a speed of two taps per second.

Preference was given to the closed circuit type of equipment throughout, on account of the immediate evidence given thereby of any interruption of current. The saving in battery plant by using a common battery for open joker and gong circuits was found to be inconsiderable, compared with cost of storage battery

Storage battery current is furnished through seven ten circuit combination storage and line switchboards with automatic control of the charging current. The circuits are brought in through two protector switchboards containing thirty-four circuits each. On the boards each circuit is protected by a pair of line fuses, a pair of lightning arresters and a pair of circuit breakers, all of which have been found to be reliable, an audible signal being given automatically when one of the circuit breakers opens.

The transmission switchboards consist of two twenty circuit main line relay boards with visual and audible indicating equipment; one ten circuit joker board carrying relays, pole changers, sounders, bells and light signals, and one ten circuit gong board with



Operators' Phone Boards, Signal Pedestal and Circuit Registers.

for individual closed circuits when proper estimate is made of time required for frequent testing by operators, or money invested in automatic appliances to determine conditions of open circuits.

For receiving apparatus on box circuits the five circuit puncturing register was selected as a unit, and nine of these instruments purchased. In case of trouble with any such register it can be removed and quickly replaced by a spare instrument, spring contacts being used in the pedestal for all connections. In addition to the eight main registers, three single punching registers are used with automatic time and date stamps as recording instruments, one for all outgoing joker signals, one to act as master register for all signals from boxes, and one to record all outgoing signals on gong lines. Some consideration was given to the use of six registers of ten circuits each, but the present instruments were at least 30 per cent less in first cost and were adaptable to locations more accessible to the operators.

ammeters for each circuit, bells, working switches and multiple key. All of the boards are equipped with single key for each circuit, with multiple gang switches for changing apparatus to manual or automatic operation by a single motion under control of the operator. A gang switch is also provided for reversal of polarity on joker lines to send the signals over them by manual transmitter. The working switches instead of being mounted on separate boards are all carried on the above switchboards, almost directly in line with the instruments or apparatus which it may be necessary to temporarily cut out for repair or inspection. The switchboards are of slate and all frames and cabinets are of metal, finished in imitation of Circassian walnut. The bases of frames and pedestals are trimmed with white marble, and the same material is used for running table around the switchboard frames and for the heavy slabs on top of cabinets.

An automatic transmitter equipment is provided for the ten joker circuits, and a three dial manual trans-

mitter is installed for transmission of signals over both joker and gong circuits. The manual transmitter is automatically wound, is equipped with both a right and a left main dial and an auxiliary dial with two speeds for fast and slow time, and has switches mounted on its base for connecting the instrument to any one or all of the joker and gong circuits. It can be used for the transmission of signals ranging from one to four figures each on either main dial, and when desired can transmit a preceding signal of one round of one to four figures on the auxiliary dial. Each main dial is independent of the other, so that while a signal is being transmitted from the right hand dial a separate signal can be set up on the left hand dial ready for immediate use, or vice versa.

Two separate private branch exchange telephone systems are provided for communication with engine houses, each station being equipped with instruments for the two circuits. One of these systems is used for transmission of alarms only, it being made possible by special key to talk to all the engine houses at once, thereby greatly facilitating the transmission of telephone fire calls and special orders. The other system is used for general communication. The grouping of apparatus for quickness of handling by the operator was particularly studied, and his position in front of the telephone boards is conveniently located with reference to the manual transmitter and the transmission switchboards. Immediately at his right is a pedestal carrying a multiple key for single or general operation of telegraph signal and joker lines, and a telegraph key and telephone jack which can be plugged into any box, joker or gong circuit. By turning in his place the operator can read the incoming signals on the puncturing registers, and in the front panel of the pedestal carrying these registers are placed the individual and gang switches for throwing an incoming box signal automatically through the joker circuits when the office is set for manual operation, thereby saving the operator's time in making this change. The elimination of lost motion on part of the operator when handling an alarm has clearly shown the ability of one man to attend to the work, and much more, on his shift, but it is not considered advisable to leave him without assistance in case of trouble during the night watches. The saving effected by having only one operator during daylight hours represents the interest upon a large part of the cost of the office.

The central office and the engine houses are fully equipped for use of telegraph signals by key and sounder, but the telephone service has been found to be superior in all general communication except the reporting of apparatus returned to quarters. For communication between officers at a fire alarm box and the central office the telegraph code is valuable. When the office is set for automatic operation any incoming fire box signal will cause instant reversal of polarity on the joker lines and stop all communication by key and sounder.

The credit for manufacturing this equipment is due to the Gamewell Fire Alarm Telegraph Company, who were the successful bidders therefor. For general efficiency and for quickness and economy of operation the entire central office has no equal.

PRESENT VALUE OF PUBLIC UTILITY PROPERTIES.

BY W. G. VINCENT, JR.

It is common practice in cases involving the values of public utility properties to first determine either the original cost new of the existing properties or the cost to reproduce, or both, and second, to make an estimate of the accrued depreciation which is deducted from the cost new to obtain the so-called "present value." This present value, as defined, is often desired instead of the cost new, for the reason that all property which has a limited life in service is supposed to depreciate and not to be as valuable after it has been in service for some time as new property of the same class out of which a greater length of service may be obtained. The soundness of this theory in general cannot be questioned, although the application of it in determining value for certain purposes, and particularly in rate cases, is open to discussion.

A public utility property is made up of a large number of physical units varying in character and value, and the problem which presents itself in determining the present value of the physical property is one which involves the determining of the present value of a great many different items and different classes of property. It is obviously impossible to arrive at the present value by considering the total value of a property as if it were new, and immediately determining from this value new the present value of the whole property. The natural way which suggests itself, and which has generally been followed, is to consider first every individual item, and after grouping these items by classes, then to consider each class, and after determining its present value, the total of the present value for all classes is obtained as representing the present value of the property. For instance: if we have a property composed of a number of pieces of machinery, a number of poles, wire, etc., and we desire to determine the present value of this property, we would begin and consider each piece of machinery and determine its value, and adding the present values of the different pieces together, obtain the present value of the machinery as a whole. We would then take up the poles and determine the value of each and by adding the present value of the individual poles together, determine the present value of all poles, etc. Therefore, the accuracy of the total obtained is entirely and absolutely dependent on the accuracy and methods used in determining the present value of the individual items of equipment, and an analysis of these methods is necessary in order to determine this accuracy.

As the total present value is nothing more or less than the summation of the values of the individual pieces of equipment or property which go to make up the whole, the determination of the present value resolves itself into the determination of the present value of each item of equipment or property, and upon considering the variety in the items and the many different classes of property, we will find that a number of individual cases will arise where special conditions will influence the present value and which will require special treatment. In general, however, the property can be segregated into groups of structures of a similar character and of similar cost, which will constitute

by far the greater part of the value of any public utility property.

The methods employed in determining the present value of the various classes of property are:

First—Present value as determined by probable life and age.

Second—Present value as determined by condition.

It is the first of these methods that it is the purpose of the author to especially discuss.

After obtaining the total cost to reproduce of some class of property, such as the rails in a railway property, it is usual to then determine:

First—The probable life in service or the number of years which the rails will probably last and satisfactorily perform the service for which they were installed.

Second—The scrap value of the rails at the end of their probable life. This value will be the amount which can be obtained for the rails less the cost of moving and delivering them to the buyer.

Third—The average age of the rails at the time that the estimate is being made.

The depreciable or wearing value is obtained by deducting the scrap value from the cost value.

Up to this point there is a general agreement, that is, value new is assumed as cost new, and value at end of useful life is assumed as scrap value; however, when the value at any time during the useful life is to be determined we find various methods being employed, but the two most commonly accepted are the so-called "straight line" and "sinking fund" methods.

It must be recognized as a fundamental economic principle that the total sacrifice made by the investor who invests \$10 in advance for some equipment which will render service for ten years is the original investment at compound interest for ten years. In cases where the investor is to be compensated for his sacrifice, it is obvious that the amount of his compensation at the end of ten years should amount to \$14.80, as this is the sum to which \$10 would compound in ten years, assuming an interest rate of 4 per cent.

There are a number of ways in which payments to the investor of certain sums can be made to accomplish this result. He can, for instance, be paid the \$10 at the time of the installation as a purchase price, or he can be paid the \$14.80 at the end of the ten years, or he can be paid certain sums annually which when placed at interest would amount to \$14.80 at the end of ten years, or he can be paid other sums semi-annually, etc., etc.

In the particular problem that we are discussing, however, it is usual to deal in annual periods and it will be interesting to see what the results will be of the different methods of annual payments.

First, it will be necessary to analyze the amount of \$14.80 which the investor should have at the end of ten years. Supposing for a moment that when the original equipment has served its useful life it will be desirable to replace it with a similar piece of equipment at the same cost. We immediately recognize then that the \$14.80 is divisible into two parts.

First—\$10, which the investor has received in the nature of a compensation for the using of his property, and,

Second—\$4.80 which the investor has received as a compensation for the use of his money invested in the property.

Bearing in mind this division of the total sacrifice and that it is also desirable to make this division in each of the annual payments, we can tabulate the following:

First—The sum to be paid each year as interest to the investor for the use of his property during that year.

Second—The sums which should be paid during each year to the investor for the sacrifice in value of his property.

It is with the second of these that we are concerned at the present time. While the interest to be returned to the investor is of course essential, for the present it is sufficient to consider that the total amount to be returned to the investor in ten years is \$4.80, as shown in column 3 of table No. 1 given below:

TABLE NO. 1.

Year.	Original Cost.	Interest Accumulated.	Depreciation.		Annual		Value at end of Year
			Straight Line.	Annual Accumulated at 4%.	Sinking Fund.	Accumulated.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	\$10.00	....	\$1.00	\$1.00	\$.83	\$.83	\$9.17
2	10.00	....	1.00	2.04	.83	1.70	8.30
3	10.00	....	1.00	3.12	.83	2.60	7.40
4	10.00	....	1.00	4.24	.83	3.53	6.47
5	10.00	....	1.00	5.41	.83	4.51	5.48
6	10.00	....	1.00	6.63	.83	5.52	4.48
7	10.00	....	1.00	7.89	.83	6.56	3.44
8	10.00	....	1.00	9.21	.83	7.66	2.34
9	10.00	....	1.00	10.58	.83	8.80	1.20
10	10.00	4.80	1.00	12.00	.83	10.00	....

In columns 4 and 5 of this table are given the annual amount of depreciation on the straight line basis, that is—considering that the depreciation each year is equal to the total depreciable value, divided by number of years that the equipment will remain in service, and the accumulated depreciation on this basis is the annual payments at 4 per cent interest compounded annually.

It will be noted that the total of the accumulated depreciation fund on this basis at the end of ten years would be \$12.00, and that by adding this amount to the \$4.80 the total amount returned to the investor would be \$16.80, which is more than the total sacrifice of the investor. It is also obvious that the accumulated depreciation fund of \$12.00 is more than would be necessary to replace the structure which originally cost \$10.

In columns 6 and 7 are given the annual amounts that it would be necessary to put aside each year at 4 per cent compound interest and the accumulations from these payments at the end of each year, which it will be noted amounts to \$10 in column 7 at the end of ten years. This amount added to the \$4.80 of accumulated interest at the end of ten years exactly equals the total sacrifice of the investor and also seems to be properly segregated, as the \$10 depreciation fund would cover the replacement of the structure.

Therefore, as far as the proper method of charging annual depreciation is concerned, it would appear obvious that the sinking fund method is correct where the fund is not disturbed. Now it also appears obvious that if the depreciation fund is to accumulate on the

sinking fund basis, the value of the property at any time is equal to the first cost less the depreciation fund at that time. For instance, should any question arise at the end of any year the value of the property would be that shown in column 8.

Now if we assume the figures in column 7 to be correct as to the proper method of accumulating a depreciation reserve, but do not admit that the deduction of this reserve from the first cost is a proper method of obtaining the present value and insist that the straight line method is the proper one, we would find that at the end of five years we would have a depreciation reserve of \$4.51 and a present value of \$5, or the sum of the present value and the depreciation reserve would fall 48 cents short of equalling the cost new.

It will be interesting to work out one or two specific cases, applying the two methods suggested and see what the results will be.

Case 1.—Assume that a tenant “A” takes a lease on a store for ten years for \$1000 cash in advance, and another tenant “B” leases the store next door, similar in every respect, for \$123 per year for ten years, payments to be made at the end of each year. If the rate of interest is 4 per cent, the terms of the leases are similar in the longrun, for if the landlord puts “A’s” \$1000 in a savings bank at 4 per cent and deposits “B’s” payments when made in another bank at the end of ten years, each account would amount to \$1480.

Now at the end of four years “A” decides to retire from business and “B,” desiring to enlarge his business, agrees to buy “A’s” lease for what it is worth. As the terms of the leases are similar as to total cost of the service each is obtaining and “A’s” lease is fully paid up, the value of the lease can be expressed in two ways:

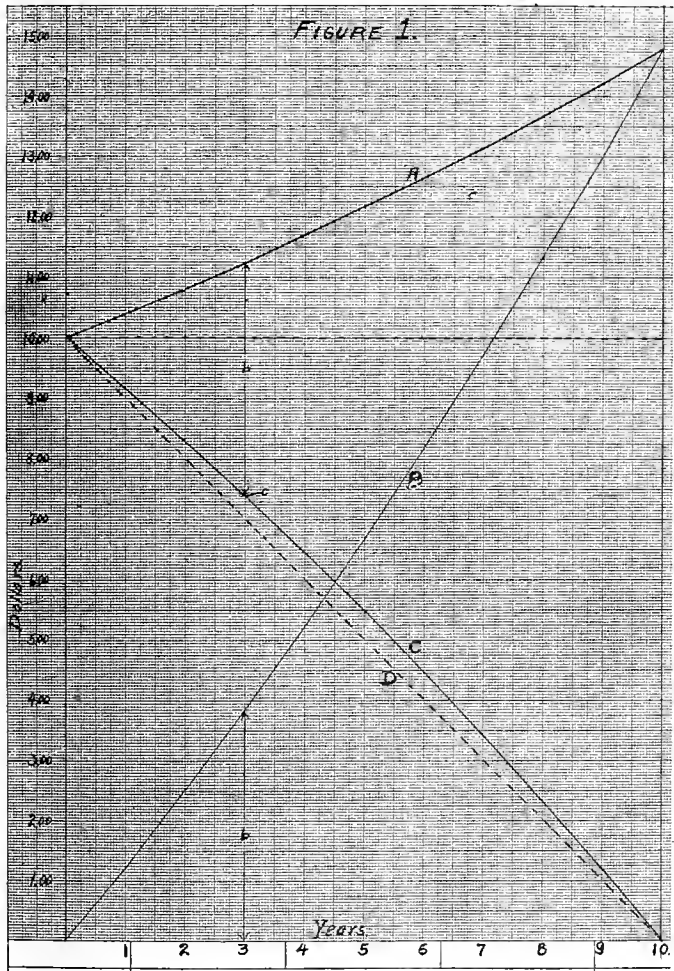
First—Some amount which when added to “B’s” sacrifice and both put at compound interest for the remaining six years, will equal\$1480.00
“B’s” sacrifice to date is..... 543.00
The amount which will equal \$1480.00 in six years is 1170.00
The difference, or the amount which “B” should pay to “A”, or the value of the lease is..... 627.00

Second—“A’s” sacrifice to date, after he has received the value of the lease from “B,” should equal “B’s” sacrifice to date for the store he leased on annual payments, or the value of the lease is the difference between the sacrifice to date of “A” and the sacrifice to date of “B.”
“A’s” sacrifice to date has been \$1000.00 at 4% compound interest for four years, or.....\$1170.00
“B’s” sacrifice to date has been (as above).... 543.00
The difference, or the value of the lease is..... 627.00

Case II.—The service rendered by a pole which costs \$10 and will give service for ten years involves an economic sacrifice of \$10 at compound interest for ten years, and if we assume an interest rate of 4 per cent this sacrifice in ten years will amount to \$14.80. Now if this same service could be purchased and paid for in equal annual payments the purchaser could afford to pay for the service some amount, which with compound interest on the payments from the time of each payment to the end of the ten years would

equal \$14.80. This annual amount would be \$1.23. In other words, the same economic sacrifice would be made by investing \$10 in advance for ten years of service as would be involved by paying \$1.23 at the end of each year for the same service for ten years.

Now if we assume two similar structures, one of which “A” has been installed at a cost of \$10 and the other “B” is leased for ten years at \$1.23 (neglecting for the moment the question of replacing the structure) at the end of any period of say six years the owner of structure “A” desires to know what the cost of the service rendered by the structure to him has been. As the total cost of both structures will be the same at the end of ten years, he computes the cost to date of the leased structure by setting down his annual payments and computing the compound interest on them up to date. Now if he computes the cost to date of structure “A” and deducts the cost to date of structure “B” he will obtain an amount which will represent what it has cost him to date to provide the service for the next four years, or the present value of the structure at the end of six years. This amount will not be the total cost of service for the next four years any more than the original ten dollars was the total cost for ten years.



This may be shown graphically as in Fig. 1 where the curve A is plotted to represent the total cost to the investor each year from one to ten years for the structure installed at a cost of \$10. Curve B represents the total cost for the leased structure. Curve C is obtained each year by deducting the ordinate of

curve B from curve A. The sums from which these curves were plotted are given in Table 2.

The result of this chart is significant in that curve C is a 4 per cent sinking fund curve.

TABLE NO. 2.

Years.	Total Cost, Structure Costing \$10.00. (Curve A)	Leased Structure. (Curve B)	Present Value A-B. (Curve C)
0	\$10.00	....	....
1	10.40	\$1.23	\$9.17
2	10.81	2.51	8.30
3	11.25	3.85	7.40
4	11.70	5.24	6.46
5	12.17	6.68	5.49
6	12.65	8.18	4.47
7	13.16	9.73	3.43
8	13.69	11.36	2.33
9	14.23	13.03	1.20
10	14.80	14.80	....

Case III.—Assume a public utility property is to be sold from "A" to "B" and they both agree on all of the terms of the sale and on the fair value of all of the property and its business, *except* the sale price for the depreciable physical property, but they do agree on the following:

Cost to reproduce depreciable property.....\$110,000.00
 Weighted average probable life 25 years
 Weighted average age 10 years
 Scrap value\$ 10,000.00

No depreciation fund has been maintained.

"B", the buyer, insists that as the property on the average will last twenty-five years and it is ten years old with a junk value of \$10,000 it is worth but 15/25th of \$100,000 plus \$10,000, or \$70,000.

"A," the seller, insists that the property is worth more than \$70,000 and submits to "B" his estimate, as follows:

First—If the depreciable property were all new it would be worth \$110,000.00 and "B" agrees that if the property were new he would pay \$110,000.00.

Second—A fair interest rate for a conservative investment is at least 4%.

Third—If for the last ten years "A" had put aside \$2401.20 annually at 4%, he would now have a depreciation reserve of \$28,828.80, and if \$2401.20 is added to the fund annually for the next fifteen years, the fund will then amount to \$100,000.00, which, with the junk value of \$10,000.00, will replace the property at the end of its life.

Fourth—If the depreciation fund of \$28,828.80 were available the property and the fund together would be worth \$110,000.00; therefore, without the fund the property is worth \$28,828.80 less than what it would be worth if the fund had been maintained, or $(\$110,000.00 - \$28,828.80) = \$81,171.20$.

It would seem that "A's" estimate is based on sound economic principles from his point of view, but now let us see if they are sound from "B's" point of view. Suppose "B" had two courses open to him:

First—Buy "A's" property for \$81,171.20.

Second—Buy another property similar in every respect, but new, for \$110,000.

If he purchased the new property and put \$2401.20 aside annually he would have accumulated sufficient money at the end of twenty-five years to replace the entire property.

If "B" purchased "A's" property for \$81,171.20 and started a sinking fund with the balance of his \$110,000, or \$28,828.80, and then added \$2401.20 annually, he would have at the end of fifteen years sufficient money in his fund to replace the entire prop-

erty, or he would be as well off as if he had bought the new property. Therefore, "A's" estimate must be accepted as sound.

However, "B's" estimate of \$70,000 seemed to be based on a sound premise and one of the estimates is necessarily unsound. If we analyze the basis of "B's" estimate we find that it is based on this premise:

The value of any depreciable property is that proportion of its original cost that the remaining life is of its total life, with proper allowance for scrap value. This premise is fundamentally unsound, as it considers first cost and not total cost.

The Wisconsin Railroad Commission in the Beloit case said:

"It seems fairly certain, in view of the facts, that if we are to consider the value of a unit of equipment as installed and in operation, the depreciation will in general occur more slowly during the earlier than during the later years of its life, and that in general the value at all times will be somewhat above the straight line drawn from cost of reproduction to scrap value. It is, however, much easier to arrive at this conclusion than it is to indicate the course actually followed by the decrease in value. It is probable that the fairest representation of this course is the sinking fund curve. Whether a 4 per cent, 3 per cent or other curve is the closest to a fair and reasonable rate depends largely upon other factors, which can perhaps be closely ascertained only by careful investigations and clear knowledge of the surrounding conditions. Where proper depreciation curves have been kept in the past, the present or existing value of a property, as determined by inventory, inspection and appraisal, plus the depreciation reserve should theoretically equal the cost new of that property.

"There is, of course, no actual connection between the rate of depreciation of equipment and the rate at which money accumulates under a given rate of compound interest. The progress of depreciation must be assumed in any case. If we are to follow the proposition that it follows a curve instead of a straight line, it seems fair to assume that this curved line has a certain general form, and it would seem reasonable to assume that the 4 per cent sinking fund curve fairly represents the progress of depreciation under average conditions."

It would appear from the above and particularly from the sentence: "There is, of course, no actual relation between the rate of depreciation of equipment and the rate at which money accumulates under a given rate of compound interest" that although the commission realized that the sinking fund method was about right, they did not realize that *there is* an actual relation between depreciation of equipment and the rate at which money accumulates where such depreciation is dependent solely upon the lapse of time.

The fallacy in the "straight line" method of determining present value lies in the failure of this method to differentiate between first cost and total cost and in incorrectly assuming that the cost of property paid for at the beginning of its life is the same as if it were paid for in equal payments throughout its life. It seems hardly necessary to point out that this assumption is directly opposed to all established economic laws governing the payment of interest, discounts, etc.

The method often employed of determining present value by observed condition is one which it is necessary to employ in dealing with certain classes of property, but it has the very serious drawback of

being based entirely upon personal opinion based upon the experience and judgment of the observer.

The Wisconsin Railroad Commission in the Beloit case in discussing present value said:

"Many appraisers oppose the use of a curve of any kind or form and rely upon the judgment of an expert as based upon the actual inspection of the equipment under consideration. Since, however, a great deal of equipment cannot be adequately examined in service, it is necessary to rely very largely upon age, and in such cases the appraiser actually depreciates upon an actual or mental curve which is based upon the more or less definite life table which is the result of his experience. More consistent and fairer results would appear to be obtained by the use of a life table compiled from the experience of a large number of experts in connection with a definite curve, even if the basis for the use of such curve rests, to some extent, upon assumptions which are more or less difficult to justify with exactness."

Where present value is desired the most accurate results will be obtained by a combination of the "Observed" and "Sinking Fund" methods, applying to each item or group of items the method which suggests itself as best adapted to give the fairest results in each case. It is only necessary to consider some of the classes of property which comprise a public utility to realize the limitations of either the observed or the average age method applied consistently to the whole property, and the result is that most appraisers make use of a combination of the two methods to arrive at a general result which they consider to be reasonable. The tendency is, however, to rely too much upon the average age method, as this method is apparently more accurate, inasmuch as it eliminates to a large degree the personal equation, and this tendency results in an application of the average age theory of depreciation in a great many cases to classes of property where the age has absolutely no relation to depreciation.

It should be borne in mind in applying either of the above methods that the average age method can only be used in determining that element of depreciation which is due to wear and tear, action of the elements and ravages of time and should in no sense be employed as a measure of the other elements in depreciations, such as obsolescence and inadequacy. Consideration should, of course, be given to obsolescence, inadequacy, etc., in determining present value, but the proper deduction which should be made on account of these elements of depreciation is entirely a question of efficiency and the functional relation of the equipment to the service which it is expected to supply.

In the above the sum of the present value and the accrued depreciation, that is the theoretical sinking fund, has been assumed as at all times being equal to original cost. This is only theoretically true where the depreciation fund is based upon the elements of depreciation which are related to the age of the property and is in no sense true of those elements introduced by other considerations than the age. In other words; in computing the annual depreciation which should be set aside for any class of property all of the elements which contribute to the depreciation, not only which have occurred, but which will possibly occur in the future, should be considered, but in determining

the present value only the depreciation which has actually occurred should be taken into consideration.

Consider, for instance, a concrete structure, such as a dam. Now at the end of any limited number of years, as five, ten or fifteen, the physical condition of this structure will in all probability be as good as it was the day that it was installed and no deduction should be made for the age of the structure in considering the present value, but in computing the annual allowances for depreciation of the property of which this dam is a part, some allowance should be made annually for the amortization of this structure, as it certainly cannot be expected that the structure will be as useful forever as it is at the time being considered.

The engineer has a position of grave responsibility to fill in the development of correct methods of valuing property and is perhaps to some extent responsible for many decisions which violate economic laws. He should, therefore, bend his energies to a careful analysis of the problems involved and work them out by considering all of the facts and principles which enter into each case.

In giving his views on the question of present value, the author has had in mind the importance of this and many other questions involved in valuations; and that, notwithstanding the amount of thought and discussion that is being given to this subject, there are wide differences in the methods in use. Believing that one reason for this condition is that the discussions have been too general and that in an effort to correlate the various phases of valuations not enough attention has been paid to the details of each problem, the author has tried to bring out for discussion his ideas on one question and in doing so has purposely omitted all matters not essential to that question.

Electrical gas purification by the Cottrell precipitation process has proved a success in removing tar from illuminating and producer gas. This is on the same principle that has been applied in the precipitation of smelter fume and cement dust by high tension electric discharges, except that alternating current is used. This electro-mechanical action condenses a dense tar mist into a few large drops, which can be readily removed by the ordinary tar extractor. A commercial plant has been in satisfactory operation since January, 1914, at the Detroit factory of the Ford Motor Company, where the producer gas is detarred.

The total heating value of a gas, as defined by the U. S. Bureau of Standards and expressed in the English system of units, is the number of British thermal units produced by the combustion, at constant pressure, of the amount of the gas which would occupy a volume of 1 cubic foot at a temperature of 60 degrees F, if saturated with water vapor, and under a pressure equivalent to that of 30 inches of mercury at 32 degrees F, and under standard gravity, with air of the same temperature and pressure as the gas, when the products of combustion are cooled to the initial temperature of gas and air and when the water formed by combustion is condensed to the liquid state.

ELECTRIC DISTRIBUTION

STANDARDS IN SAN DIEGO.

G—Motors.

BY L. M. KLAUBER.

[Continued.]

Section G covers the following topics:

G 10—Service Wires.

G 20—Fuses and Wiring Data.

G 30—Weights and Pulley Data—G. E. Motors.

G 40—Starting Compensators—G. E. Motors.

G 50—Motor Belts.

Since the San Diego Company does not ordinarily engage in either the sale or installation of motors, the information given is only such as is of assistance to troubleshooters handling consumers' complaints. Naturally, only the voltages found on the company's lines are considered.

G 10. Service Wires for Motors

G 10.1 Service Wires for Motors.

H.P. of Motor.	Size of Service.		500 D.C.
	Single Phase. 110-V. 220-V.	Three Phase. 220-V. 440-V.	
1	8	...	8
2	8	...	8
3	6	...	8
5	2	...	8
7 1/2	1/0	...	8
10	2/0	...	8
15	...	6	8
20	...	4	8
25	...	...	8
30	...	...	8
35	...	1/0	8
40	...	1/0	8
50	...	1/0	8
75	...	3/0	1/0
100	...	300,000	1/0

The above figures are for overhead services using W.P. wire. In the case of single phase motors the size wire is selected by taking that size which has a continuous carrying capacity 100 per cent in excess of full load current. In the case of three phase and D.C. motors the carrying capacity of the wire is 50 per cent in excess of full load. Where underground services are run necessitating R. C. wire, do not use the above tables, but use the tables given on sheets G 20.1 to G 20.4 inclusive.

G 20. Fuses and Wiring Data. The information contained in the handbook consists of the accompanying schedules. These are similar to those found in the Underwriters' Tables, except that standard sizes of switches and fuses have been substituted.

G 20.3 Three Phase Motors. 440 Volts—60 Cycles.

Horse Power.	Full Load Current in Amperes.	Size of Wire, B. & S. Gauge.	Size of Switch, in Amperes.	Size of Starting Fuses, in Amperes.	Size of Running Fuses, in Amperes.	Size of Conduit.
1	1.6	14	30	5	3	3/4
2	3.6	14	30	10	5	3/4
3	4.3	12	30	10	10	3/4
4	5.5	12	30	15	10	3/4
5	6.5	12	30	15	10	3/4
7 1/2	10	12	30	20	15	3/4
10	13	10	30	30	20	1
15	20	8	60	40	30	1
20	25	6	60	50	35	1 1/4
25	31	6	100	75	40	1 1/4
30	38	4	100	75	50	1 1/2
35	43	4	100	100	60	1 1/2
40	49	2	100	100	60	2
50	61	2	200	150	75	2
75	93	00	200	200	150	2
100	122	000	300	250	150	2 1/2
150	182	300,000	400	400	250	3
200	240	400,000	500	500	300	3
250	300	500,000	600	600	400	3 1/2

G 20.1 Single Phase Motors. 110 Volts—60 Cycles.

Horse Power.	Full Load Current in Amperes.	Size of Wire, B. & S. Gauge.	Size of Switch, in Amperes.	Size of Fuses, in Amperes.	Size of Conduit.
1	4.5	14	30	10	1/2
1 1/2	7.5	12	30	15	3/4
2	13	10	30	25	3/4
3	23	8	60	50	1
4	35	6	100	75	1
5	45	4	100	100	1 1/4
7 1/2	55	2	100	100	1 1/2
10	78	1/0	200	150	2
15	104	2/0	200	200	2
20	130	2 1/2	200	200	2
25	155	3	200	200	2
30	180	4	200	200	2
35	205	5	200	200	2
40	230	6	200	200	2
45	255	7	200	200	2
50	280	8	200	200	2
55	305	9	200	200	2
60	330	10	200	200	2
65	355	11	200	200	2
70	380	12	200	200	2
75	405	13	200	200	2
80	430	14	200	200	2
85	455	15	200	200	2
90	480	16	200	200	2
95	505	17	200	200	2
100	530	18	200	200	2

200 Volts—60 Cycles

Horse Power.	Full Load Current in Amperes.	Size of Wire, B. & S. Gauge.	Size of Switch, in Amperes.	Size of Fuses, in Amperes.	Size of Conduit.
1	2.5	14	30	6	1/2
1 1/2	3.5	12	30	10	3/4
2	6	12	30	14	3/4
3	12	10	30	25	3/4
4	17	10	60	35	3/4
5	22	8	60	50	1
7 1/2	27	6	60	60	1
10	40	4	100	75	1 1/4
15	53	2	200	125	1 1/2

G 20.2 Three Phase Motors. 220 Volts—60 Cycles.

Horse Power.	Full Load Current in Amperes.	Size of Wire, B. & S. Gauge.	Size of Switch, in Amperes.	Size of Starting Fuses, in Amperes.	Size of Running Fuses, in Amperes.	Size of Conduit.
1	14	14	30	3	3	3/4
1 1/2	12	14	30	6	6	3/4
2	12	12	30	10	10	3/4
3	12	12	30	15	15	3/4
4	12	12	30	20	20	3/4
5	11	12	30	25	25	3/4
7 1/2	15	10	30	30	30	1
10	21	8	60	40	25	1
15	27	6	60	60	35	1 1/4
20	39	4	100	75	50	1 1/2
25	51	2	100	100	65	2
30	63	2	100	125	75	2
35	76	0	200	150	100	2
40	88	00	200	200	125	2
45	100	000	200	200	125	2 1/2
50	124	0000	300	250	150	2 1/2
75	184	300,000	400	400	250	3
100	249	500,000	400	500	300	3 1/2

G 30. Weights and Pulley Data—G. E. Motors.

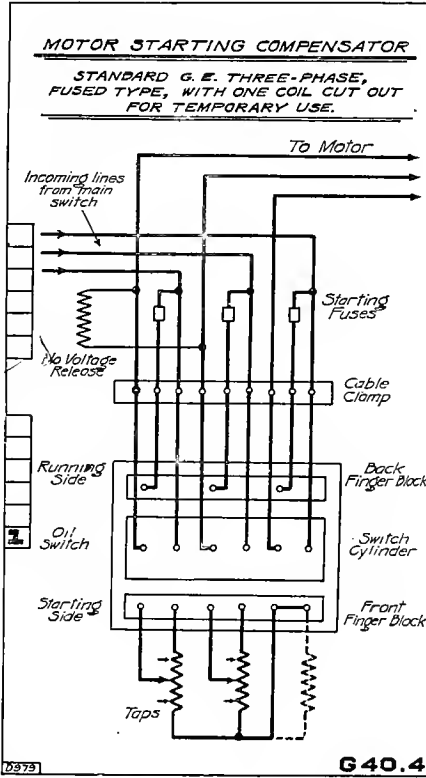
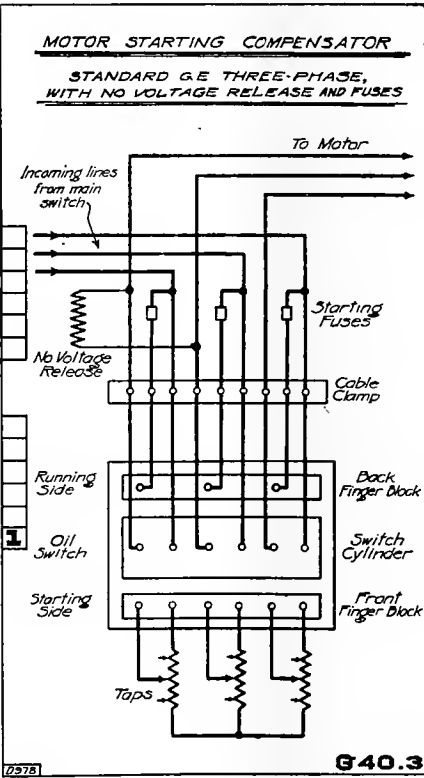
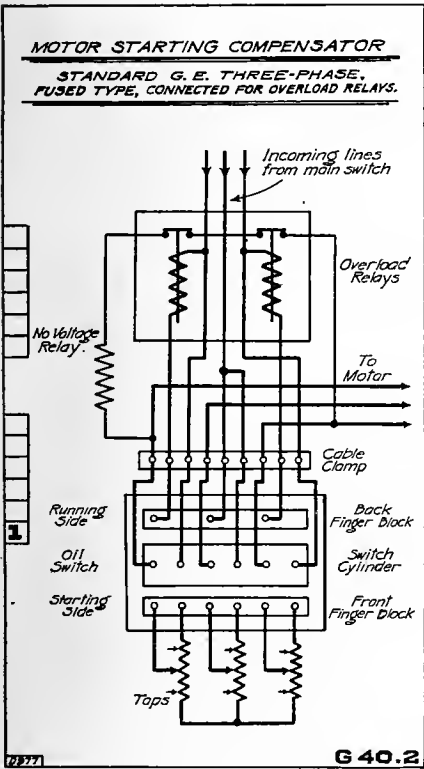
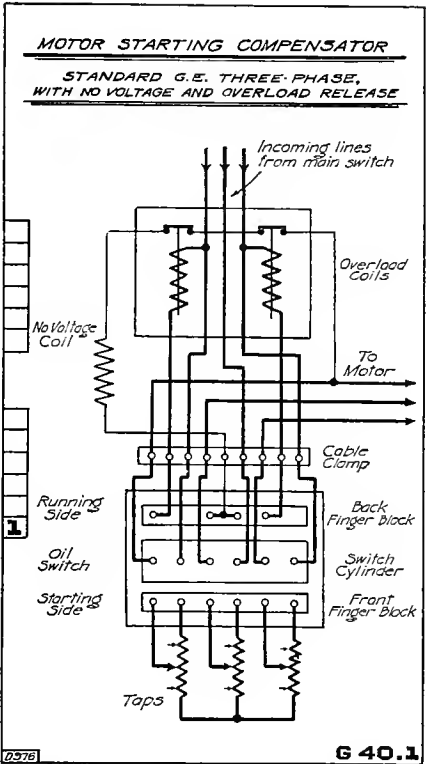
The data contained in this section is often of assistance in emergency installations where existing line shafting necessitates special pulleys.

G 30.1 G. E. SQUIRREL CAGE INDUCTION MOTORS.

Standard Pulley Data and Weights. Three Phase, 220 or 440 Volts.

Horse Power.	Syn. Speed.	Full Load Speed.	Net Weight With Base.	Standard Pulley.			Min. Pulley.
				Dia.	Face.	Bore.	Face.
1/2	1800	1690	55	3 1/2	2 1/2	3/4	1 1/4
1	1200	1120	85	3 1/2	2 1/2	3/4	1 1/4
1 1/2	1200	1130	100	4 1/2	2 1/2	1	2 1/2
2	1800	1700	85	3 1/2	2 1/2	3/4	1 1/4
3	1200	1130	110	4 1/2	2 1/2	1	2 1/2
4	1200	1130	125	4 1/2	2 1/2	1	3
5	1800	1700	125	4 1/2	2 1/2	1	3
7 1/2	1200	1130	150	4 1/2	3 1/2	1	3 1/2
10	1800	1720	150	4 1/2	3 1/2	1	3 1/2
15	1200	1135	195	4 1/2	4 1/2	1 1/2	4 1/2
20	1800	1730	195	4 1/2	4 1/2	1 1/2	5 1/4
25	1200	1140	290	5 1/2	4 1/2	1 3/4	6 3/4
30	900	855	380	7	5	1 3/4	7 1/4
35	1800	1740	290	5 1/2	4 1/2	1 3/4	6 3/4
40	1200	1150	380	7	5	1 3/4	7 3/4
45	900	860	560	8	5	1 3/4	8
50	1800	1740	380	7	5	1 3/4	7 3/4
55	1200	1140	560	8	6	1 3/4	8
60	900	865	610	8	6	1 3/4	8 1/2
65	1800	1740	390	7	5	1 3/4	7 3/4
70	1200	1140	610	8	6	1 3/4	8
75	900	865	885	10	7	2 1/4	13
80	720	690	955	10	8	2 1/4	9

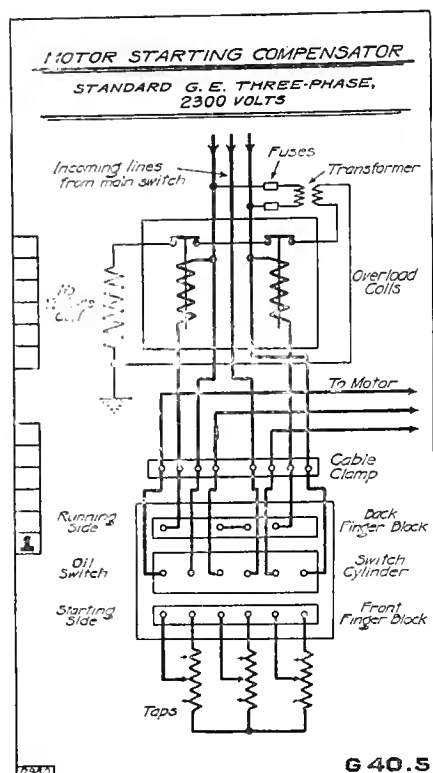
G. E. SQUIRREL INDUCTION MOTORS. Standard Pulley Data and Weights. Three Phase, 220 or 440 Volts.										G 30.3—G. E. SQUIRREL CAGE INDUCTION MOTORS. Standard Pulley Data and Weights. Three Phase, 2200 Volts.									
Horse Power.	Syn. Speed.	Full Load Speed.	Net Weight With Base.	Standard Pulley.	Min. Pulley.					Horse Power.	Syn. Speed.	Full Load Speed.	Net Weight With Base.	Standard Pulley.	Pulley. Minimum				
			Dia.	Face.	Bore.	Dia.	Face.	Bore.					Diameter.	Face.	Bore.	Diameter.	Face.	Bore.	
20	1800	1740	610	8	1 7/8	7	9			20	1200	1150	885	10	7	2 1/8	6 1/2	13	
20	1200	1150	885	10	2 1/8	6 1/2	13			20	900	870	955	10	8	2 1/8	9	10	
20	900	865	955	10	8	2 1/8	9	10		25	1200	1150	955	10	8	2 1/8	8	13	
20	600	565	1425	13	10	2 3/4	9	11		25	900	865	1240	10	10	2 3/8	9	10	
25	1200	1150	955	10	8	2 1/8	8	13		25	720	690	1425	13	10	2 3/8	9 1/2	11	
25	900	865	1240	10	10	2 3/8	9	10		35	1200	1150	1240	10	10	2 3/8	9	10	
25	720	680	1425	13	10	2 3/8	9 1/2	11		35	900	850	1425	13	10	2 3/8	10	11	
25	600	575	1425	13	10	2 3/8	11	11		50	900	865	1740	13	13	2 3/4	10 1/2	15	
35	1200	1150	1240	10	10	2 3/8	9	10		50	514	485	2950	16	17	3 1/2	13 1/2	17	
35	900	860	1425	13	10	2 3/8	10	11		75	900	865	2240	15	15	3 1/4	12	17	
35	720	680	1425	13	10	2 3/8	12 1/2	11		75	514	490	3535	21	19	4	16	21	
35	600	575	1740	13	13	2 3/4	11	15		100	720	690	3535	21	19	4	15 1/2	21	
50	900	865	1740	13	13	2 3/4	10 1/2	15		100	450	430	5250	28	23	4 1/2	18	23	
50	720	695	2240	15	15	3 1/4	10	17		150	720	700	4105	24	21	4 1/2	18	25 1/2	
50	600	575	2240	15	15	3 1/4	12	17		150	450	430	6090	32	25 1/2	5	21	29 1/2	
50	514	490	2950	16	17	3 1/2	13 1/2	17		200	600	575	6090	32	25 1/2	5	21	29 1/2	
75	900	865	2240	15	15	3 1/4	12	17											
75	720	695	2950	16	17	3 1/2	14 1/2	19											
75	514	490	3535	21	19	4	16	21											
100	720	690	3535	21	19	4	15 1/2	21											
100	600	575	3535	21	19	4	17	23											
100	450	425	5250	28	23	4 1/2	18	23											
150	720	695	4105	24	21	4 1/2	18	25 1/2											
150	600	575	5250	28	23	4 1/2	19 1/2	25 1/2											
150	450	425	6090	32	25 1/2	5	21	29 1/2											
150	400	375	6090	32	25 1/2	5	23 1/2	29 1/2											
200	600	580	6090	32	25 1/2	5	21	29 1/2											



The heat unit has not been defined by any international congress, but is usually taken as the quantity of heat required to raise the temperature of unit mass of water one degree, the original water temperature being specified. The calorie is the quantity of heat required to raise the temperature of 1 gram of water 1 degree at 15 degrees, C. The British thermal unit (B.t.u) is the quantity of heat to raise the temperature of 1 pound of water 1 degree at 59 degrees F.

Potash from feldspar is the subject of a series of experiments now being conducted in the Kingston district of Ontario, Canada.

The constitutionality of the Oregon water code has been upheld by the Federal District Court in the case of the Pacific Livestock Company against the Oregon Water Board in the determination of the Silvers River water rights.



G 50.1 —BELTS FOR MOTORS

Size of Belt:

Determine the width of a belt required to transmit a given h.p. from the following:

$$\text{Width} = \frac{\text{H.P.} \times \text{M}}{\text{Speed}}$$

The speed should be expressed in feet per minute.

Values of M are as follows:

- For single ply leather M = 800
- For double ply leather M = 500
- For canvas belts 4 ply M = 800
- For canvas belts 6 ply M = 530
- For canvas belts 8 ply M = 460
- For canvas belts 10 ply M = 400
- For canvas belts 12 ply M = 355

Ply:

Single ply belts should be used up to about 6 in. in width; from 6 to 20 in. use two ply; from 20 to 40 in. use three ply.

Distance Between Centers:

Pulley centers should not be less than 3 times the sum of the diameters of the pulleys. Better results will be secured if the distance be made 4 or 5 times the sum of the diameters.

Width of Belt:

The pulley face should exceed the width of belt, as follows:

- 1 in. to 2 in. by $\frac{1}{4}$ in.
- 2 in. to 5 in. by $\frac{1}{2}$ in.
- 5 in. to 10 in. by $\frac{3}{4}$ in.

[To be continued.]

- 10 in. to 24 in. by 1 in.
- 24 in. to 36 in. by $1\frac{1}{2}$ in.

Speed:

Maximum belt speed should not exceed 5000 ft. per minute.

$$\text{Belt speed} = \frac{\pi \times \text{dia.} \times \text{R.P.M.}}{12}$$

Speed Reductions.

The following belt reductions should not be exceeded:

H.P. Motor.	Reductions.
1/15	15 — 1
1	10 — 1
5	8 — 1
10	6 — 1
20	5 — 1
50	4 — 1

Length of Belt:

The length of belt required is $1.57(D + d) + 2L$.

L = Distance between pulley centers.

The length of belt in a roll is found by adding the diameters of the hole and the roll, in inches; then multiplying by the number of coils in the roll times 131. The answer will be in feet.

Side:

The grain or hair side of a belt should run next the pulley.

Laps:

The motion of driving should be with the laps.

STANDARDS FOR GAS SERVICE IN THE WEST

BY R. S. McBRIDE.

[Concluded.]

Heating Value Standard for Oil Gas.

Although in a number of states considerable attention has been given to standards of heating value for coal gas and water gas, little attention has been given until recently by any state or city authorities to this question as applied to oil gas. Applying the same general methods that have been used in studying water gas and coal gas conditions, the Bureau undertook the consideration of oil gas conditions. It is desirable to give only a brief outline of the method followed and of the conclusions.

The first problem considered was how oil gas is made; particular attention was given to the question of manufacturing limitations, i. e., as to what was the highest heating value that could be made under certain conditions; what difficulties would be met with the higher and the lower qualities under consideration, etc. The gas produced is somewhat different in some of its properties from either coal gas or water gas; and it was therefore also considered from the standpoint of the user. The uniformity possible in supplying this gas was considered, as well as the relative costs for different qualities. As in the case of water gas and coal gas, one of the most important considerations was found to be the effect of changing quality upon sales. This factor is not only important, but it is also probably the most difficult one upon which to get any thoroughly satisfactory information.

The data which has been placed at the disposal of the Bureau by various companies has led to several conclusions:

1. Oil gas companies can make a gas of over 600

B.t.u. per cubic foot without serious manufacturing difficulty.

2. The advantage with which the higher qualities of oil gas are made varies greatly with the character of generator used, as well as with the kind of oil employed.

3. Oil gas cannot be made of as uniform quality from day to day as is possible with certain other kinds of gas.

4. The character of oil gas is similar to that of coal gas, both in usefulness to the customer and in chemical composition, except in the case of gas made more recently in San Francisco which is unusually high in saturated hydro-carbons.

5. And finally, it is generally, if not always, found to be more economical, calculating in B.t.u. per dollar, to supply gas of higher heating value than 550 B.t.u. per cubic foot.

How Oil Gas is Made—Operating Limitations.

Oil gas is essentially the product of destructive distillation of hydrocarbon oil. This accounts for the great similarity in composition of oil gas and coal gas, the former being produced from oil, the latter from bituminous coal, under such conditions that somewhat similar reactions occur. The generating machinery used for production of oil gas resembles markedly the water gas machinery and the process is also somewhat similar as it is carried out in alternate heating and gas making periods. However, the chemical processes involved and the effect of various factors are so different from those found in the case of water gas that it is undesirable to make comparisons with the latter when considering oil gas. Comparison may be made with the carbureting process used in water

gas manufacture, but even this has led to some misunderstandings.

Several processes have been devised for manufacturing oil gas. It is only possible to review briefly the principal operating methods and to point out those manufacturing limitations which must be considered in the adoption of a standard for oil gas service.

There are three distinct processes in use for the manufacture of oil gas: (1) the "straight-shot process" in which a single-shell machine is utilized; (2) the two-shell process in which the second shell is used only to conserve heat, no gas being made in it; and (3) the two-shell process in which gas is made in both shells.

There are many variations in each of these processes; for example, the heating oil may be introduced at the top or at the bottom of the shells; the making oil may be introduced at the same point as the heating oil or at the opposite end of the machine; gas may be taken off at one end of one shell or at the side of the larger of the two; a secondary blast may be used or not. These and numerous other variations in the process make it difficult to compare operating efficiencies in one city with those obtained in another.

The temperature maintained in the generator varies with the character of oil employed and with the quality of gas which is to be made. In general, a higher temperature produces a larger quantity of poorer gas; and, within limits, the converse is true that the lower the temperature at which the generator can be operated the higher will be the quality of the gas. This condition results from the fact that the decomposition of the oil into gas is a progressive process.

The significance of this successive decomposition is apparent if we consider that a specification of a certain heating value for the gas will necessitate that the generator be operated at such temperature as to produce gas at least of the richness specified. The standard fixed is therefore a determining factor in controlling the works operation. Moreover, if the quality be fixed too high it will be found that certain difficulties of operation are introduced because of the low temperature which must be maintained in the generator. For example, when operating at a low temperature a smaller amount of lamp black may be made; but this as produced is mixed with more or less of the difficultly removable tar and the resulting tar and lamp black mixture is difficult to handle. This trouble is met particularly in the cases of some of the straight-shot machines. Another difficulty met under these conditions is the larger amount of carbon which is deposited in the generator and the resulting increase in the frequency with which the machines must be "burned out."

In a large number of plants, the superheated oil is introduced with the steam apparently without attaining the highest efficiency of atomization. This no doubt is the cause of a great deal of the operating difficulty reported. Great care should be taken to atomize the oil and introduce it through burners which do not destroy the effectiveness of the atomization. If the oil is not immediately evaporated when it enters the hot checker brick, the liquid will be greatly super-

heated in some parts and very incompletely heated in others before it can be converted into gas. The result of this so-called "stewing" is the production of a tar difficult to handle, the carbonization of the checker work with resulting lowering of generator efficiency, and a general operating difficulty due to irregularity of temperatures throughout the generators. However, when the oil is thus introduced in a fine spray, which permits almost immediate vaporization in the generator, practically none of the spray drops in liquid form into the checker brick and thus the "stewing" of the oil is eliminated.

When the gas leaves the generator it carries suspended in it lamp black varying in quantity from 5 to 50 pounds of carbon per 1000 cubic feet of the gas; it also carries a considerable amount of tar and naphthalene. The gas leaving the generator bubbles through water in the wash box and most of the lamp black is separated from the gas by this process. If the gas is not properly freed from lamp black in the wash box the mixture obtained in scrubbing is made up of tar, water, and lamp black in proportions that are at times difficult to separate and handle. Notable progress has been made in operation of the wash box in some of the California plants where the gas is passed for the distance of 5 to 15 feet under water in order that practically all of the lamp black may be removed before the gas enters the scrubber. This elimination of lamp black greatly facilitates scrubbing and results in the production of a tar which can be easily handled.

Some of the California companies have been able practically to overcome the difficulties of carbonizing the generators and of handling the tar and lamp black mixtures (or eliminating these by keeping tar and lamp black separate). There is every reason to believe that equally effective operating practice can be developed elsewhere to remedy those conditions which are in some plants still making the manufacture of a 600 B.t.u. gas a matter of some difficulty.

Oil Gas Cost Data.

Thus far the question of cost has not entered into this discussion, and it is evident that the relative cost of gas of different qualities should not be considered until it is clear that no serious operating limitation is to be expected.

For convenience of consideration, the cost data for oil gas were roughly classified. This classification has been somewhat arbitrarily made in many cases, but where it is desired only to estimate relative costs for different qualities exact estimates are not so necessary as they would be in a rate-fixing case. Throughout these compilations the result desired has been the determination for the several conditions of the number of B.t.u. available to the customer for each dollar of cost to him and the cause of fluctuation in cost with changing quality has been carefully considered.

The data which were received from the various Washington, Oregon, and California companies have been carefully examined by the Bureau; but it is not necessary to discuss these data in this paper. The summary already given indicates the general conclusions which may be drawn as to the heating value

standard for oil gas. It should be noted, however, that the difference in heating value available to the customer for one dollar, has not been found very great under the different conditions studied, or in other words, from the standpoint of minimum cost to the customer according to the data submitted, it is not very important whether the quality requirement be 550, 575, 600 or 625 B.t.u. It has been found that a discrepancy of 2 or 3 cents in the estimation of the items which make up the "proper selling price" for the different qualities, might be sufficient to change the conclusions as to the relative advantage of the different qualities.

Significance of the Change in Sales With Change in Quality.

If the quality of the gas supplied in any city is materially changed it is evident that the quantity which will be sold may also change. In some cases the total amount of heat required by the customer is independent of the quality of the gas; under other circumstances the volume of gas utilized will be practically constant regardless of the quality. This latter condition is found in the case of appliances which are turned on for fixed periods and which would not require (or perhaps more exactly stating the case, would not receive) a new adjustment for a new quality of gas. As a matter of fact in practice it is probable that some intermediate condition would represent the average.

Few data are available to show what changes in sales have actually accompanied changes in quality from the few cases for which the Bureau has secured such data, it is doubtful whether any general conclusions can be drawn. It should generally be anticipated that in case a change in quality of gas were made, the price per thousand being constant, the change in sales would be less proportionately than the change in quality.

If an increase in quality is not accompanied by a proportionate decrease in the quantity required, this fact will tend to make the cost per heat unit to the customer less with the richer gas, because some items of expense are constant in the aggregate for any period independent of sales. This fact should be recognized. However, it is not justifiable to take only this factor into consideration in determining which condition is the more desirable from the standpoint of the customer. The reason for this is as follows: Let us assume a 10 per cent increase in quality of gas is proposed for any hypothetical case; and let it be assumed that it is clearly shown that the decrease in sales to be expected will be only 5 per cent of the present sales. Then if estimates of the proper price to charge for the two qualities should show conclusively that the richer quality would deliver at least 1 or 2 per cent more to the customer for each dollar, we still must consider the fact that although the change proposed would give the customer more for each dollar, at the same time we admit he is going to use about 5 per cent more heat under the new condition. And since the sales were assumed to decrease less rapidly than the quality increased, it is evident that if such change were put in force the customer

would get the benefit of more heat for each dollar, but at the same time the average customer would be paying more per month than formerly. The above case is purely hypothetical and in actual practice perhaps no such condition might be found. However, it shows that it is impracticable to make an assumption other than that the total heat which is to be used under the two conditions is the same.

Conclusions Drawn From Oil Gas Data

The conclusions which have been reached after full consideration of the data presented to the Bureau may be summarized as follows:

(1) Only one experienced oil gas engineer has submitted estimates which indicate as great economy in cost of a heat unit delivered to the customer in gas of less than 600 B.t.u. per cubic foot.

(2) In order to conclude from this single set of estimates that 600 B.t.u. gas would cost the customer more per heat unit than 550 B.t.u. gas it is necessary not only to assume that the sales would decrease in proportion as the quality increased, but also that the expense per thousand on practically all items would increase directly as the sales decreased.

(3) The assumption that the sales would decrease as rapidly as the quality increased can not be admitted.

(4) All expenses per thousand would certainly not increase proportionately as rapidly as the sales decreased.

(5) If the single estimate, which indicates greater economy for the poorer gas, is recalculated on a basis believed to fit the facts more exactly, it appears that the richer gas would be equally economical in any case unless the expense items per thousand increased more than nine-tenths as rapidly in percentage as the sales decreased.

(6) The opinions of the majority of engineers consulted, which indicate that a 600 B.t.u. oil gas costs less per heat unit put in the holder than 550 B.t.u. oil gas, are accepted by the Bureau as probably generally applicable.

The general conclusion from the cost data studied is, therefore, that gas of 600 B.t.u. per cubic foot may be regarded as at least equally if not more economic, from the standpoint of the total cost to the customer per heat unit, than any poorer quality.

Other Factors Affecting Heating Value Standards.

After it has been established what manufacturing limitations there are and what is the relative cost per heat unit delivered to the customer with different gas qualities, there still remain several factors which must be taken into consideration. The most important of these are worthy of brief consideration.

The lamp black briquettes made as an oil gas by-product form a high grade fuel, particularly valuable in those localities where no anthracite or high grade coke are available. This fact is sometimes used as an argument favoring the manufacture of a poorer quality of gas since with the poorer quality of gas a somewhat higher yield of lamp black is obtained. However, unless the production of a larger amount of this by-product decreases the net cost of the gas per heat unit delivered to the customer, it is hardly

reasonable to urge the production of a larger amount of the lamp black.

The more uniform in quality a gas is, the greater satisfaction with which it can be utilized. It is important, therefore, in fixing any standard of quality to ensure that it is possible to obtain uniformity in quality. There are two causes of variations: First, irregularities in manufacture, and second irregular distribution losses, either of which will produce irregularity in quality of the gas at the point of utilization. As far as could be determined by the Bureau, no greater difficulty would be met in securing reasonably uniform manufacturing results with one quality of gas than with another, at least up to a gas of 600 or perhaps 630 B.t.u. per cubic foot; and under the climatic conditions of the states where oil gas is made, the distribution losses are very small. It seems therefore that manufacturing irregularities and distribution losses need not be regarded as serious factors in the consideration of a heating value standard for oil gas so long as the requirement be 600 B.t.u. per cubic foot or lower.

In most cases the usefulness of a gas is regarded as proportional to its heating value and as far as the Bureau can determine this is the only reasonable assumption which can be made in the consideration of various heating values. Any argument based on the assumption that the customer will utilize more nearly a constant volume of gas than a constant amount of heat in any given period is not conclusive, since it frequently leads to the conclusion that a lower quality of gas will permit delivery of more heat to the customer for the dollar but will require the customer to pay a larger amount per month for the total service received. A line of argument leading to such conclusion certainly should not be followed in fixing a heating value standard. Under certain conditions there is no doubt that a somewhat higher efficiency will be obtained in the utilization of a poorer quality of gas than with a very rich quality, but it is doubtful whether any material increase in the percentage of total heat utilized would be found by decreasing the quality from 600 to 630 as commonly supplied to 550, the lowest value usually considered desirable as a heating value standard.

In the fixing of standards for heating value the possible developments of the industry are often given extended consideration. This, of course, is proper if any of the developments immediately contemplated would be interfered with by the standard proposed. However, under state commission control where frequent change in requirements can be brought about as changing economic conditions may demand, it is usually unnecessary to give extended consideration to any conditions not actually existent or certain to be met in the immediate future. For example, it is rarely necessary to consider prospective changes in costs or availability of fuels unless large changes in price or entire discontinuance of supply is probable in the immediate future. State commission control has as one of its chief advantages the flexibility of the requirements under which the companies operate. This flexibility will care for changing economic conditions as they arise, but it is usually unnecessary to anticipate

changes by setting standards suited to future conditions whereas higher or better standards could be justifiable for the immediate present.

One factor, sometimes ignored in fixing standards, is the attitude of the public to the requirement which may be proposed. There is no doubt that comparison of standards or comparison of rates between various cities or states may lead to serious misunderstandings and perhaps to unfair complaint, but the fact must be recognized that such comparisons always are and always will be made by those who cannot be familiar with the technical phases of the subject.

It is desirable therefore to anticipate such criticism by eliminating in so far as is fair and just the chance for unfavorable criticism of any party involved. This fact has lead the Bureau to believe that in any case where those in authority can, without injustice to the public or to the company, fix a standard or rate similar to those standards or rates in force elsewhere, so long there is some advantage inherent in such particular standard or rate. In advancing any such argument, however, the Bureau would wish it understood that the probable attitude of the public as regards a rate or a standard should be considered a determining factor only in those cases where there is no technical reason which would justify a positive decision in one way or another. In other words, this public relations aspect of the case should be regarded as an important phase of the subject only when all other factors as determining a decision have been considered without reaching a satisfactory conclusion.

General Summary.

In the consideration of the information which has been gathered by the Bureau in connection with its study of oil gas conditions considerable difficulty has been met in the determination of the actual facts relative to a number of technical questions. This difficulty has arisen largely because of the conflicting evidence presented by different gas engineers whose experiences have led them to adopt different operating practices or to utilize different types of machinery. After having found such cordial co-operation between the different gas interests engaged in the manufacture of water gas and coal gas, the Bureau has been greatly surprised to note among the oil gas engineers the lack of co-operative effort in the development of their plants and processes. In several cases companies have been found which have adopted types of machinery or operating methods which had previously been discarded after extended experimentation in other plants. Even allowing for the difference in opinions naturally resulting from operating under different conditions, it is hard to see why certain machinery has been installed and certain processes have been adopted which appear to have been supplanted elsewhere by other machinery or processes markedly more efficient.

From the information which has been collected as indicated throughout this paper, the Bureau has found no reason to change the essential parts of its recommendations as given in Circular No. 32, it seems in general that these recommendations are suited not only to water gas and coal gas but also to the western states where oil gas is the principal product.

LETTER TO THE EDITOR.

Inductive Interference Report.

To the Editor:

Sir: I would like to be allowed a little space in your valuable magazine to express to your readers the views of a telephone employee, as influenced by the published discussion in Spokane on the report of the Joint Inductive Interference Committee as submitted to the State Railroad Commission of the State of California, and the General Order No. 39 which was issued by the above commission soon after the filing of this report.

Upon reading the abstract of the above discussion as published in your magazine, the following points were very strongly impressed upon me: In the first place, no disbelief in the technical reports was apparent, and, secondly, the power men therein quoted were uniformly opposed to the telephone companies being allowed to interpose any effective objections to any operation or proposed operation of the power companies.

After a later reading of the complete transcript of this discussion, it was seen that very favorable comment was made upon the scientific aspect of the investigation, thus, by absence of denials apparently assuming the truth of the technical contentions. However, the idea seemingly was absolutely preposterous that any telephone company should be given any legal right to request, or in extreme cases, demand, such modifications in the operation of a power system as will minimize the disturbances which are not allowing even reasonably efficient operation of a given group of telephone lines. One speaker appears to consider this course illegal, as he proposes to prevent any other commission following the lead of the California Railroad Commission. Another speaker, while making favorable comment on the scientific work, termed the practical ruling to be an actual "insult" to the power companies. No insult was assumed at being proven to be the cause, but only in assuming anything to be due to a telephone company. Apparently another case of Divine Right.

About the only discussion, as bearing on the accuracy of the technical points, was brought in by a manufacturer of air break switches, who is naturally somewhat opposed to any regulations which tend to curtail his list of possible patrons.

But in this connection, I would state, that a matter of only a few weeks ago, all of the telephone circuits in a territory covering five hundred or more square miles, were rendered so noisy that operations on many lines had to be absolutely suspended for over twenty-four hours. Inquiry at all load dispatchers' offices showed their telephone lines to be unusually noisy, but that their power system were all operating normally. However, on the afternoon of the second day of this trouble, it was discovered that an air break switch had dropped out at a pole on a branch line. The station from which this branch line was energized was a substation having no methods of ascertaining whether or not this, or any other connected line was balanced for residual or any other kind of current.

This case of trouble was, as a matter of fact, fifteen or twenty miles from any of the telephone lines which were affected. This case shows that a connected

line, although not actually on a parallel, can give extreme inductive effects at times, when connected with lines which comprise a parallel, also that neutral ammeters, as required by General Order No. 39, would at times give valuable indications of abnormal operations and, also, that individual air break switches can be productive of very bad inductive disturbances.

Referring also to a recent letter from a contributor to your magazine, I would also say that introducing the common battery telephone lines into this question, merely tends to cloud the issue, as General Order No. 39 and the preceding report, both explicitly exclude subscribers lines from the rulings, and limit the cases of parallels (on the part of the telephone companies) to inter-office metallic lines.

He also states there are doubtless many cases where the power companies have not been so innocent in their transgressions, yet in his closing paragraph, he contends that the cost of any changes shall be borne by the beneficiary. In citing the following case, which is an actual California occurrence, this lack of innocence is shown. This case also shows the injustice of the statement, that the beneficiary shall bear the expenses incurred in relieving the inductive disturbances, when applied to the ordinary California case, wherein the transmission line has been built over or close to a previously, existing telephone, telegraph or signal lead.

On a certain toll lead of about two hundred miles in length, long distance telephone service had been given for a period of years, possibly not ideally perfect, but to a very large degree, entirely satisfactory. A few years ago, a power company commenced to develop a territory through which this toll lead passed. A high tension transmission line was built for about twenty-five miles with parallels ranging from one quarter of a mile to four miles in length. On the longest parallel, the average separation of the transmission and telephone wires is hardly more than ten feet. In this parallel the associated primary wires were placed so close to the telephone wires, that in several places, these primary wires have hung down through the telephone lead. Several physical contacts have occurred due to this cause, the results of which leave little to the imagination of a telephone man, but I believe no damage has occurred to the primaries.

Owing to the extreme lack of separation between the various wires in these two leads, it became necessary for the power company to protect itself and its primaries, by removing them as far as possible from their transmission line, of which they were afraid, and carry these primaries as close as possible to those telephone wires of which they were not afraid. As a natural result of this policy, the telephone company has suffered severely, both from induction and from physical hazard, the total exposure to parallels being about fifteen miles of close parallels in this case. While it is true that primary wires are excluded from General Order No. 39, it is also true, that merely reasonable separations, such as this order will insure, will prevent any more such physical hazards to be constructed.

The transmission on these telephone lines has dropped fifty or sixty per cent. And, regardless of a specially designed transposition scheme installed in

the telephone lines, absolute isolation of all telephone wires at each end of one four-mile exposure leaves these telephone wires so hot that they are unsafe to handle with bare hands. And this in a short four-mile stretch.

Based on this discussion, and your recent contributor's letter, it would appear that priority rights of occupation of a given location, such as this telephone company had, are to be absolutely disregarded. And when the efficiency of the telephone system has been so reduced, solely due to the inductive interference both from normal and abnormal operation, of the adjacent power system, the telephone company shall, as the beneficiary of any changes, be generously allowed to bear all of the expenses of such changes. Very naturally, however, this becomes an extremely serious question, as the number of existing parallels will be found to be extremely great. It will, however, be difficult to find but few, if any, cases where a telephone toll lead has been constructed closely adjacent to an existing transmission line. This would tend to indicate an extreme lack of interest, to say the least, on the part of the constructing engineers of the power system, regarding the efficient or inefficient use of the telephone systems which happen to be in the way, on the new routes the power men have chosen.

It was assumed at Spokane that the power companies were in a box, the door of which was under the control of the telephone companies. It would seem, however, to be nearer the truth, to state, that this becomes the first time the telephone companies have been able to even see out of the box in which they have been confined since the first existence of high tension networks.

Many operators have been carried from long distance offices unconscious from the severe shocks sustained on these toll lines when switching changes are made. These shocks are not electrical shocks, but result from terrific crash occurring on these lines at such times, and which will vividly illuminate vacuum arresters used on these lines. Numerous tests have been made which absolutely prove that these shocks are due to power switching operations. Power station operators in many cases remove their telephone from the line at such times, but the commercial operator, and the subscribers do not have the advantage of previous information. This case is one that doubtless can be entirely cared for, only by great separation or entire avoidance of parallels.

One speaker at Spokane, advocates the use of reactances and condensers for quieting the telephone lines, but then finds a high powered transmitter is necessary. But, what a simple matter it would be to use high powered transmitters at all telephones which will be liable to use the toll service over lines paralleling high tension lines which may be causing inductive disturbances of a severe character. It has been stated by power men that owing to the extremely noisy condition of many of their own dispatching lines, many cases of reports coming to the load dispatchers are unintelligible, but that upon looking at the clock they knew what to expect and therefore record the case in the station log book, knowing

that a certain operation was due at a certain time of day at a given station. If, under such conditions experienced men are unable to even guess at what is being said on a given line, what chance have two strangers, possibly aged and infirm, to communicate over a line which, while not equally noisy, yet approaches to a dangerously approximate condition.

It hardly seems possible that the speakers in this Spokane discussion realized the fact that power men were equally represented on this committee with the signalling interests, and having a greater representation on the committee than the telephone companies. A personal acquaintance with some of these members would hardly lead one to believe that they were of such a low mentality as to allow anything of such a vicious character as these regulations are called, to be "slipped over" on them.

Much work by power companies has already been completed, and much more designed in the past year or two, in some sections of California at least, which is conforming to a marked degree, with the requirements of General Order No. 39. There is also much construction still in use, and which is of recent date, comparatively, which to any one having any conception of the danger, constitutes a physical hazard which is a positive disgrace to the engineers who were responsible for the work. And in many cases personal responsibility cannot be shifted, as telephone officials have made personal verbal complaints to the engineers and general officials in charge at the point of complaint, and in at least one case has the complaint been justified, for one lineman was killed at one of these points, in a matter of only a few weeks after the complaint was made. Luckily for the telephone company, however, it was one of the power linemen.

So, to the power men of California, who have already started to do work along the lines designated by General Order No. 39, these rulings do not seem as harsh, as to some of the other school, who are either too selfish or too blind to see the rights of others or to those to whom the value of an extra five feet on the top of a pole, is in excess of the value of a human life.

These power men who see the benefit to signalling lines of others, which may be obtained by these required changes, also see, that it may be possible for their own officials to talk on some lines of their own, where now, none but experienced operators are able to converse intelligibly. It may, however, be found, that the power men who were on this Joint Inductive Interference Committee, have during the past two years, educated themselves to a point far ahead of these self-appointed critics, who have so strenuously objected to these rulings.

In closing, I wish to state that I am in no way representing the Joint Inductive Interference Committee. The opinions herein stated being those I have held for a long time, and which I feel have been plainly verified, by the extreme rancor expressed by the men who either insist no changes shall be made, or if made, are to be paid for by the injured party. And such a viewpoint certainly lacks justice as considered by

A TELEPHONE EMPLOYEE.

Los Angeles, Oct. 19, 1914.

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Almost all engineering work is based upon such rigid physical laws, such definite mathematical rulings, that there has been little difficulty in deciding as to what is the best engineering practice to meet given conditions. Yet there would be no engineers if it were not for honest differences in opinion. Especially is this true for the new science of valuation which is now engaging the attention of many engineers and concerning which there has been so much controversy.

Considering valuation as a science, a mistake has been made in trying to fit observations to assumed rules. Heretofore there have been many abstract generalizations and few concrete facts from which to formulate a proper procedure. Evaluation has been based upon telescopic rather than microscopic evidence.

The remedy lies in a more detailed study of individual conditions. There must be many facts to classify before classification can be commenced. Generalization should not be attempted until there are sufficient data to justify an unprejudiced judgment.

An excellent start in this direction has been made elsewhere in this issue by W. G. Vincent, who has given much study to the conditions of the great hydro-electric network supplying the light and power needs of northern California. By first limiting the discussion to valuation for rate-making purposes and then narrowing to the problem of depreciation he has been enabled to concentrate upon a few details at a time and thus reach some valuable conclusions.

Depreciation is the center about which valuation revolves. After the loss in value has been determined there is comparatively little difficulty in calculating present value.

Assuming that the value new of any piece of apparatus was its cost new and that its value at the end of its useful life will be its scrap value, Mr. Vincent argues that its value at any intermediate period in its probable life is equal to the first cost minus the depreciation fund which has accumulated at compound interest on the sinking fund basis. This "sinking fund" method he believes to be preferable to the older and simpler "straight line" method which assumes that depreciation is a direct function of time. He demonstrates that the fallacy in the straight line method lies in its failure to differentiate between first cost and total cost and in its assumption that the initial cost is the same as if it were paid for in equal installments throughout its life. Furthermore he contends that there is an actual relation between the time depreciation of equipment and the rate at which money accumulates.

Although greatly in favor of this sinking fund method Mr. Vincent is broad enough to recognize that sufficient time has not yet elapsed nor enough expert engineering experience has not yet been had to furnish reliable data for "life tables" of engineering structures.

So he advocates that it be combined with the observational method in order to obtain accurate results.

Yet these two methods, while capable of refinement, are still far from perfect. The observational estimate of damage from use and deterioration is absolutely dependent upon the personal equation. One man's judgment may be as good as another's and there are usually as many different valuations as there are observers. The sinking fund system of determining life expectation is liable to be based upon unreliable data and its plausibility may lead to erroneous conclusions. Mr. Vincent recognizes this danger when he advises that the method not be applied to obsolescence and inadequacy, a functional depreciation which is indeterminate for future conditions. None of the dozen or more recognized methods of estimating depreciation are able, nor should they be expected, to anticipate the loss in value due to improvement in the art. The path of progress is a curve which the finite mind has not plotted.

The main point which this and other papers emphasize is the need for more definite information as to the mortality of equipment. Each of the engineering societies would do well to appoint a committee to collect data from which standard deductions may be drawn. With such information as a foundation it will then be possible to develop a true science of valuation.

Since the hostile reception at the Spokane Institute meeting to the report of committee on inductive interference, a number of engineers, including several members of the committee, have rallied to its defense and endeavored to take the "fear" out of "interfe(a)rence," as far as the power interests are concerned. They have proven the inequity that formerly existed and have justified many of the steps which have been taken to correct the difficulty.

The report was presented and discussed at the October meeting of the San Francisco Section of the American Institute of Electrical Engineers and will form the subject of the November meeting of the Los Angeles Section. At the former meeting emphasis was laid upon the fact that the report was not final, but subject to future revision. No protest of moment has yet been received from the California power companies and promise was made that full hearings would be accorded any complaints of discrimination against air-break switches.

Even at this meeting sufficient credit was not given to the scientific merits of the report. This aspect of the investigations is worthy of an extended discussion unobscured by commercial issues. The committee has given ample assurance that the studies and recommendations were made in the spirit of true research. The conclusions in several of the appendices are especially valuable studies of the phenomena in electric circuits.

A vigorous statement of the telephone companies' viewpoint is also published elsewhere in this issue. The author, because of modesty, has requested that his name be withheld from publication, but the editor

will give it to anyone interested. Human sympathy naturally flows to the under-dog, a role which the telephone company has occupied for many years, their situation having aptly been compared to running a hospital next door to a boiler shop.

The greatest good accomplished by the report, is the feeling of mutual respect and sympathy which has been created between the telephone and power companies. Each now understands the difficulties under which the other has been working and each side has made concessions so as to insure not only a physical harmony between transmission and communication circuits but also a mental harmony between the men engaged in their operation. Above all else they have demonstrated that it is possible for engineers to get together and reach a common understanding without calling the ubiquitous lawyer into the controversy.

Governor West of Oregon apparently believes in "letting George do it" when it comes to removing a state engineer. The Desert Land Board, and incidentally the office of state engineer, is proposed to be abolished by the George bill, an initiative measure—initiated by Governor West. Many engineers and others devoutly hope that the ensuing result will be that usual when George is asked to do it.

It is claimed that the present incumbent in office is not personally acceptable to the governor and that it is considered more expedient to abolish the office on the ground of economy than the incumbent on the ground of personality.

Neglecting all personalities, it is the consensus of expert engineering and legal opinion that the administration of Oregon's water resources since 1909 has been most satisfactory. The water code of 1909 provided a full determination of existing rights in a single proceeding, the proper distribution of water by state officials and complete control of the acquirements of new rights. Its constitutionality was upheld by the Federal District Court during the past month and many of its provisions have been embodied in the proposed California code. There has been no accusation of mal-administration, but simply a plea of economy, without regard to the need for the work or its efficiency.

The enactment of this bill would mean the cessation of joint topographic and stream survey in cooperation with the U. S. Geological Survey. The data on stream flow forms the basis for investment in irrigation and hydroelectric plants and are essential to the development of the state. Many other plans for the beneficent utilization of Oregon's natural resources would also be delayed by its passage.

The Oregon Society of Engineers, the Oregon Hydroelectric Commission and the commercial clubs of several of the larger cities have condemned the measure and endorsed the activities of the state engineer. They adduce strong arguments to prove that the efficiency of their model water law will be impaired and that economy will not be promoted by the George bill. A vote in its favor is a backward step, negation here represents progress.

The George Bill

Inductive Interference

PERSONALS

W. S. Herrick, an electrical contractor of Sanger, Cal., was a business visitor at San Francisco during the week.

Charles Perry of the Perry Electric Company, Coalinga, Cal., spent several days during the week at San Francisco.

W. E. Hayes, proprietor of the Hayes Electric Shop, Santa Rosa, Cal., spent a few days in San Francisco during the past week.

Wilbur Pounder, Pacific Coast sales manager Hubbard & Company, expects to make a short trip throughout the Sacramento Valley this week.

Robert Howes, hydraulic engineer at Seattle, is inspecting the Sauk and Sittatle power site forty miles from Seattle for the city engineer of Seattle.

D. C. Jackling, president Utah Power & Light Company, of Salt Lake City, recently returned from Alaska, where he has been for the past two months.

R. H. Manahan city electrician of Los Angeles who has recently returned from the East where he has been studying fire alarm systems, spent a few days last week in San Francisco.

Thomas Mirk, president Hunt, Mirk & Co. of San Francisco, is on a business trip throughout the southern part of the State. He expects to return to his office in about ten days.

A. J. Myers, Pacific Coast manager Wagner Electric Company, expects to return to San Francisco about the first of the week from Los Angeles and the Southwest, where he has been for the past week.

E. C. Jones, gas engineer of the Pacific Gas & Electric Company, has been elected president of the American Gas Institute. Mr. Jones is also president of the Pacific Coast Gas Association and prominent in the plans of the International Gas Congress to be held at San Francisco in September, 1915.

Thomas Finigan, vice-president Pierson, Roeding & Company, San Francisco, was elected vice-president in charge of entertainment at the Atlantic City convention of the American Electric Railway Manufacturers' Association. The 1915 convention of the American Electric Railway Association and affiliated organizations will be held at San Francisco.

Pierson, Roeding & Company announce the resignation of **Ralph L. Phelps** as manager of their safety cable department and the appointment of **C. G. Gauntlett** as manager of that department, together with the underground conduit and cable department. Mr. Phelps expects to go into business for himself, his plans being announced later. Mr. Gauntlett has just returned from an Eastern trip.

R. H. Sterling, formerly property agent of the Southern California Edison Company and at one time manager of the American River Electric Company at Stockton, has succeeded **John T. Huntington** as manager of the Santa Barbara Gas & Electric Company at Santa Barbara, Cal. Mr. Huntington has been appointed district agent of the Southern California Edison Company at San Pedro, Cal.

James P. Sprunt, detail and supply salesman of the Salt Lake office of the Westinghouse Electric & Manufacturing Company, has been discharged from St. Mark's Hospital, where he was sent as a result of injuries incurred in a railroad accident in the Logan yards of the Oregon Short Line Railroad Company. **Ralph Dinwoody** of the Inter-Mountain Electric Company, was also on the train but suffered no damage aside from a severe shaking up.

Charles N. Black, vice-president and general manager of the United Railroads of San Francisco, has returned from his trip East, where he presided over the annual convention of the American Street Railways Association held at Atlantic

City. The next convention of the association will be held in San Francisco next October, and Mr. Black was delegated to make all necessary arrangements and find the hotel accommodations, as unquestionably the full force of the association will come to San Francisco next year.



Howard Joslyn, author of the leading article on Seattle's fire alarm system in this issue, is city electrician at Seattle and is responsible for the excellent installation which has been made there. Mr. Joslyn is one of the pioneer electrical engineers on the Pacific Coast, having come to Seattle in 1888 after graduating from Wabash College in Indiana. He assisted in the installation of the equipment of the Domestic Heat, Light & Power Company, later being made manager. In 1894, he became asso-

ciated with the Westinghouse Company as engineer and salesman at Tacoma, resigning in 1897 to assume the duties of city electrician in charge of the Tacoma municipal light and power plant and signal service. During 1898-1901 he acted as electrical engineer for the Snoqualmie Falls Power Company, resigning to enter the Northwest office of John Martin & Co. This and private engineering work engaged his attention until 1903, when he assumed his present duties. Within the past ten years he has not only increased the signal facilities over 500 per cent, but also has been instrumental in securing municipal electrical inspection in accordance with Code requirements. During the four years that he has had charge of the inspection bureau inspection has been put on an established basis, resulting in much benefit to citizens and workmen. He is a member of several engineering organizations and one of the best-known electrical men in the Pacific Northwest.

MEETING NOTICES.

Seattle Section A. I. E. E.

The first meeting for the new season was held at a local cafe on December 20th. After dinner the work for the year was outlined by the chairmen of the executive and program committees. President Lindsay then reported on the Detroit meeting, at which he was the official representative of the Seattle Section. Later John Harisburger reported to the meeting of the Pacific Coast Sections held at Spokane in September, after which the meeting adjourned.

Portland Section of American Society of Civil Engineers.

The Portland Association of Members of the American Society of Civil Engineers held their annual meeting at the Commercial Club last week and elected the following officers: President, George C. Mason; second vice-president, John T. Whistler. The terms of the first vice-president, secretary and treasurer do not expire for another year. John H. Lewis, State Engineer, read an interesting paper on "State Engineer's Department and its Relation to Development in Oregon."

Portland A. I. E. E. and N. E. L. A. Sections.

The next meeting will be held on the night of November 10th at the new building of the Pacific Telephone & Telegraph Company, Portland, Oregon, at which time the building will be thrown open for inspection. W. D. Scott will give a talk illustrated by lantern slides on the construction of the telephone company's Portland building and typical central office equipment.

Mr. G. P. Nock and W. D. Scott will give a paper on "The Telephone Plant With Relation to Fires."

On December 8th the meeting will be held in the auditorium in the Journal Building and the paper of the evening will be presented by Mr. J. C. Stephens, civil and hydraulic engineer, on "Hydroelectric Developments in Spain."

Utah Electric Club.

The regular weekly luncheon of the Utah Electric Club was held at the Commercial Club Thursday, October 22d. W. H. Gregory, attorney for the Salt Lake Route, discussed the Interstate Commerce Commission and its relation to the railroads outlining the history of the regulation of interstate commerce from the time of the 13 original colonies down to the present date. He assigned as one of the fundamental reasons for the adoption of the Constitution of the United States the necessity which the colonies felt of having a centrally organized government to deal with the multitudinous problems arising from inter-colony commerce and intercourse, and showed how the Interstate Commerce Commission as we now have it was the outgrowth of the complex problems arising from the rapid development of the railroads from the latter half of the 19th century.

Oregon Society of Engineers.

The regular noon-day luncheon was held at the Hotel Burson, Portland, Oregon, October 19th. The speaker of the day was Mr. W. H. Galvani, property and tax agent of the Pacific Power & Light Company. The chairman of the day was E. G. Hopson, supervising engineer U. S. Reclamation Service. Mr. Galvani spoke on "World Peace."

Mr. Galvani arranged his title especially to appeal to engineers who are accustomed to deal with "facts." These facts embraced statistics of the cost of war, which now amounted to $3\frac{1}{2}$ times the total amount of world wealth in gold and silver, and over 70 per cent of this had been incurred in the last 100 years. Over 8000 peace treaties had been signed in 3000 years. Taxes per capita had increased over 500 per cent in the last 100 years to take care of this war debt. That during the last 100 years Canada and the United States had lived side by side without any armament at all. While all the vast preparations of Europe and Asia had only tended to breed more war and added war debts.

He further followed historically the causes of the present war in Europe and methods pursued by all nations when engaging in war to claim that they were only fighting to obtain peace. He appealed to the engineers to lend their influence for peace.

WASS-HAEL.

The annual festival of Wass-Hael, celebrated from time immemorial during the winter solstice by the Norsemen and Saxons and revived as an annual custom in San Francisco by a number of jovial spirits in the electrical fraternity, will be again celebrated this year on Saturday afternoon, December 19, 1914.

At a preliminary meeting held Monday it was decided to hold this reunion at Bergez-Franks restaurant, where Camille promises to provide some new and tempting culinary innovations and the committee will spring several new, novel and pleasing features of entertainment.

Those invited to assist in making this year's celebration the most successful of any attempted are

T. E. Collins	A. V. Thompson
N. K. Cooper	H. H. Cudmore
H. G. Aylsworth	R. E. Eltringham
A. E. Wishon	Jos. S. Thompson
F. H. Poss	L. A. Somers
T. C. Morris	A. E. Rowe
H. H. Daley	H. E. Sanderson
Wm. McKinley	Al C. Joy
E. J. Moldrup	Alan E. Morphy of Los Angeles

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision authorizing the Contra Costa Gas Company to issue 611½ shares of its capital stock of the par value of \$100, per share, and \$10,900 of its first mortgage 6 per cent 10 year bonds. The commission's order provides that these bonds are to be sold at not less than 90 per cent of their face value and accrued interest. Authority is also given S. Waldo Coleman to transfer certain franchises granted to him by the towns of Concord, Martinez, Pittsburg and Antioch, to the gas company.

The commission has rendered a decision authorizing the Hugson Telephone Company of Stanislaus county to issue 5000 shares of its common capital stock having a par value of \$1 per share. Of this amount 3675 shares are to be issued in lieu of an equal number of shares previously issued without the consent of the commission; 550 shares are to be issued to F. C. Nickle to cover expenditures previously made for additions and betterments, and 775 shares are to be issued for the purpose of providing funds for extensions to the company's telephone system.

The commission has rendered a decision authorizing the Northern California Power Company to issue 5000 shares of its 6 per cent cumulative preferred stock having a par value of \$100 per share to its stockholders at not less than \$80 per share. The proceeds derived from the sale of this stock are to be used for reimbursing capital account in the sum of \$225,000 and for additions and betterments to the applicant's properties in the sum of \$175,000.

The California Street Cable Railroad Company of San Francisco filed an application with the commission last week requesting authority to issue \$384,000 of serial bonds having a par value of \$1000 each, at a price not less than 90. These bonds will bear interest at the rate of 6 per cent and will mature in blocks annually—the first block maturing January 1, 1916, and the succeeding blocks maturing respectively on the first day of January of each succeeding year up to and including January 1, 1927. The company proposes to use the proceeds from the sale of these bonds in refunding outstanding bonded indebtedness falling due January 1, 1915, amounting to \$900,000. The difference between the amount secured from the sale of the proposed bonds and the outstanding indebtedness will be made up from moneys which the company now has in its sinking fund.

The commission has issued a supplemental order authorizing the Sonoma Valley Water, Light & Power Company to pledge its bonds in the sum not exceeding \$30,000 as collateral for a \$15,000 loan. It is provided in the order that the loan shall be made at a rate of interest not to exceed 8 per cent and for a period not exceeding 6 months. The commission has also issued an order extending the time in which the company may issue \$30,000 of its 6 per cent bonds from October 1, 1914, to December 31, 1914.

The commission has made a supplemental order approving the form of a trust deed to be executed by the Southern Counties Gas Company of California to the Central Trust Company of Illinois and William T. Abbott.

The commission has rendered a decision authorizing notes amounting to \$2,116,575 previously issued by the Northern Electric Railway Company without approval of the commission. The commission also authorized notes amounting to \$37,079.50 issued by the Marysville & Colusa Branch and notes amounting to \$118,750 to subsidiary corporations of the Northern Electric Railway Company. The purpose of the order just issued is to place the creditors holding notes now invalid in the same position as they would have been had their notes been legally issued with the authorization of the commission.

The commission has rendered a decision authorizing the Pacific Gas & Electric Company to renew a promissory note in the sum of \$100,000 to the National Conduit & Cable Company, bearing interest at the rate of 6 per cent per annum and payable not later than October 20, 1915.

NEWS OF IDAHO PUBLIC SERVICE COMMISSION.

A complaint has been filed with the Public Utilities Commission of Idaho by the mayor and council of Wallace, Idaho, alleging that the rates charged for service by the Northwest Light & Water Company which company has a monopoly of the electric and water business of that city, are too high and asking that the commission order a reduction.

TRADE NOTES.

Link-Belt Company has changed its Seattle offices from 512½ First avenue South to First avenue South and Railroad Way.

The Westinghouse Electric & Manufacturing Company has moved its Seattle offices from the Central building to the Alaska building.

The Seattle offices of the Westinghouse Electric & Manufacturing Company have been moved from the Central Building to the Alaska Building.

The Dalles Electric Works of the Dalles, Oregon, have obtained the electrical contract for the new high school building being erected in The Dalles.

The Johnson Service Company, Seattle, has been awarded the contract for installing temperature regulators, thermostats, etc., in the new high school at Kalispell, Montana.

W. A. Kraner Company of Portland, Oregon, has obtained the electrical contract for the new administration building being erected by the University of Oregon at Eugene, Oregon.

The Balfour, Guthrie Company is installing 3-20 and 1-50 h.p., 220 volt, 3-phase, 60 cycle motors on the O. W. R. & N. Company's Dock at the foot of Russell street, Portland, Oregon.

The C. H. Wheeler Manufacturing Company has supplied the Inspiration Copper Company of Arizona with three complete condenser equipments and a 3000 kw. condenser equipment to the city of Pasadena.

The William E. Chase Engineering Company of Seattle was the low bidder and probably will be awarded the contract for installing the curb lighting system along First avenue, from Bernard to Cedar street, Spokane, Wash. The bid amounted to \$70,400.

The Edison Storage Battery Company, of which H. J. Mitchell is Seattle manager, is installing a storage battery of 100-cells, B-4, 80 ampere hours in the snag puller "Swinomish," which is being constructed by Hall Brothers at Winslow, Wash., for the United States Government.

The Nevada Valleys Power Company has let a contract to J. W. Finch of Riverside, Cal., for the construction of its 82 mile transmission line from the government power house at Lahonton, Nev., (which they have leased from the government for a period of ten years) to Rochester, Nev. Construction will begin November 5th.

W. R. Hendry of Seattle has purchased the interests which J. F. NePage and V. S. McKenney formerly held in the concern of W. R. Hendry & Co., and has disposed of his holdings in the NePage-McKenny Company to Messrs. McKenny and NePage. Mr. Hendry will continue to conduct the business of W. R. Hendry & Co., high tension installation engineers.

The General Electric Company has obtained an order for the motors to equip the new mill being built by the Weyerhaeuser Lumber Company at Everett, Washington. The motors vary from 3 h.p. to 250 h.p. and are 550 volt, 3-phase 60 cycles. There will be 218 motors of various sizes installed in this mill. All the switchboard equipment will be furnished by the General Electric Company. The amount of the contract is approximately \$60,000.

H. H. Manny has opened an office at 436 Henry Building, Seattle, as a strictly manufacturers' agent and contemplates handling practically the same lines that he has handled for the past few years. Among these lines are the National Telephone Supply Company, Cleveland, Ohio; Paragon Electric Company, Chicago; Robinson Fire Apparatus Manufacturing Company, St. Louis; and the Marion Insulated Wire & Rubber Company, Marion, Indiana. The business at 436 Henry Building is being conducted as the Manny Supply Company.

The San Francisco office of Allis-Chalmers Manufacturing Company has sold recently 22 engines and 11 gener-

ators to be used on an oil pipe line between Coalinga and Martinez; a 350 k.v.a. a. c. generator, exciters and motors to the Mountain King Mining Company of San Francisco; a 7 million gallon pumping engine for the city of Santa Ana; a 500 kw. steam turbine alternator with auxiliary apparatus for California Pine & Redwood Lumber Company of Portola, Cal; also a 14x21 Allis-Chalmers Diesel engine to J. B. Dale, Phoenix, Arizona.

The County Commissioners of Kern County have awarded to the Power Equipment Company of San Francisco the contract for the construction of the Keene power line, which is to be used in the operation of the new county rock crushing plant. This line is ten miles in length over a very rough route. The longest line spans are 3200 feet long and there is an average of but eight spans per mile for the entire line. The transmission line as well as the telephone line will be of ¼-inch Siemens Martin steel cable, supported on suspension insulators. The supporting structures will be of cedar, with fir cross-arms.

The strike of inside wiremen which was precipitated in Salt Lake City by the refusal of the electrical contractors to do business with E. A. Wilcox, business agent for Local No. 354 of the Electrical Workers, was settled on October 21st by the decision of the Salt Lake Federation of Labor with which the Electrical Workers are affiliated to oust Mr. Wilcox from the position of business agent. Following this action a meeting was held between the representatives of the Trade Council and the Electrical Contractors, and all points of difference between them were settled. The electrical workers and members of other branches of the Building Trades Council who had struck in sympathy resumed work on Friday and the work on several important buildings, including the Newhouse Hotel, Eagle Gate, and Richmond Apartments, the Whitmore Apartments, the Vissing Apartments and the Ensign Ward Chapel, will be rushed to completion. By the new agreement just entered into which is substantially the same as the one under which the electrical wiremen had been previously working, the rate of pay will be increased from \$4.50 to \$5.00 with time and a half for over-time work on January 1st, providing business conditions are such as to warrant such an increase.

PUBLICATIONS RECEIVED.

"The Thermal Properties of Steam," by G. A. Goodenough, has been issued as Bulletin No. 75 of the Engineering Experiment Station of the University of Illinois. The bulletin presents a critical discussion of the experimental investigations of the various thermal properties of steam, an outline of the thermodynamic relations that must be satisfied, and finally the development of a general theory of superheated and saturated steam. As a basis for such a theory the well-known Munich experiments on specific volumes and specific heats are taken and properly correlated through the Clausius relation. The assumed characteristic "equation" for steam is shown to fit the experimental points with extreme accuracy, and other tests are given to show the superiority of the equation over Lunde's equation, which has heretofore been employed. The equation for specific heat gives a corresponding close agreement with the Knoblauch and Mollier points. Simple mathematical manipulation leads to explicit expressions for heat content and entropy, and various tests applied show that the values thus deduced are in excellent agreement with the best experimental evidence. The range of temperature through which the theory appears to be valid extends from 32 degrees to 600 degrees F. for saturated steam. The corresponding upper limit of pressure is above 1500 lb. per sq. in. The result of the investigation is a formulation of the properties of steam for which the following claims may be urged: 1, absolute thermodynamic consistence; 2, extreme accuracy; 3, simplicity; 4, flexibility; 5, great range of validity.



INDUSTRIAL



REFLECTORS FOR NEW HIGH EFFICIENCY MAZDA LAMPS.

The semi-indirect unit, as shown in Fig. 1, consists of a Druid glass outer envelope within which is suspended a Holophane prismatic glass reflector; this latter directs the light upward toward the ceiling. Air passes downward between the reflector and envelope and upward through the center of the reflector, passing between the lamp and reflector.

The diffusing unit, shown in Fig 2, consists of an outer envelope of heavy opal with a bowl at the bottom of crystal roughed glass. Air enters around the lower band of the fixture and escapes through the hood above.



Fig. 1. New Semi-Indirect Unit with Prismatic and Diffusing Glass Combination for New High Efficiency Lamps.

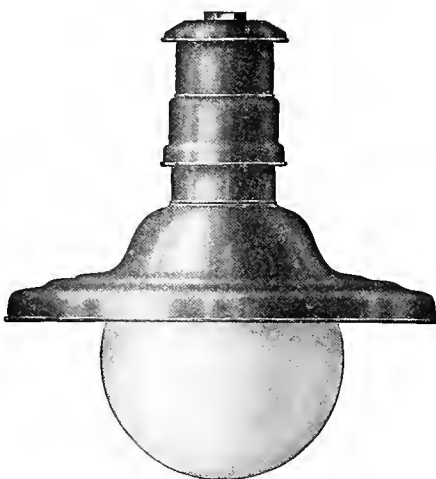


Fig. 3. Enameled Steel Reflector.

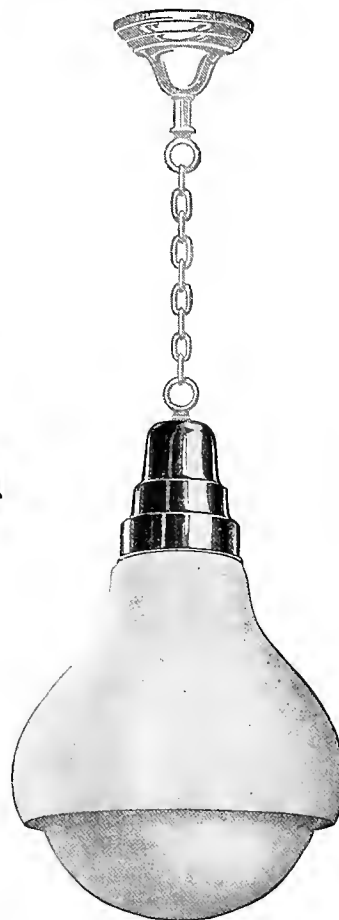


Fig. 2. Heavy Opal Envelope With Bowl.

For the illumination of platforms, shops, yards, etc., two types of enameled steel reflectors have been designed, the deep bowl B. E. E.-1000 and the shallow bowl B. E. D.-1000. The screening angle of the shallow bowl unit, shown in Fig. 3, is 85 degrees, while that of the deep bowl unit is approximately 70 degrees.

To meet the rapidly growing demand for lighting units to accommodate new high efficiency 750 and 1000 watt Mazda lamps, the Holophane Works has just completed the development of a line of reflecting and diffusing units for this service. Because of the high intrinsic brilliancy of the new lamps, as well as the high temperature of the filaments and necessary change in lamp construction, it has become necessary to develop this entirely new line of lighting units to accommodate the new lamp.

These units, as shown in the accompanying illustration, include enameled steel, Holophane prismatic and diffusing types. The three designs here illustrated are typical of each class.

AN ELECTRICAL CHRISTMAS.

One of the most attractive propositions, which the commercial section of the National Electrical Light Association has ever offered to central stations, is a booklet entitled "Gifts That Please," a Christmas booklet to promote the sale of heating appliances with a resulting increase in the central station load.

The booklet deals in an attractive manner with the various electrical appliances which make suitable Christmas

presents. It is attractively prepared and will appeal particularly to the housewife. It brings out the modern idea of giving presents which have a utilitarian as well as an artistic value.

The booklets are designed to be enclosed with the monthly statements of the central station, as well as distributed over the counter to people coming into the office to pay their electric light bills. They may also be distributed from the various electrical stores throughout the town where they are to be employed.

The price has been established at \$15 per 1000; \$8.50 per 500 and \$6 per 250. These prices make the booklet within the reach of every central station, large or small. The price includes imprinting with the name and address of the central station. Envelopes of special design may also be obtained at a rate of \$3 per 1000, if so desired.

Inquiries for copies should be sent to N. H. Boynton, sales manager publication committee, Commercial Section N. E. L. A., Box 387, Cleveland, Ohio.



NEWS NOTES



INCORPORATIONS.

SAN FRANCISCO, CAL.—The United Electric Company of California, \$10,000, shares \$10 each, subscribed \$30, by G. E. Campbell, P. Santoiemma and F. T. McDougal.

SEATTLE, WASH.—The Bremerton Gas Company has been incorporated with capitalization of \$100,000 by Adam Schortgen, Frank L. Clarke and Lane Summers. W. S. Summers, 1037 Henry Building, attorney.

SIDNEY, MONT.—Articles of incorporation have been filed for the Sidney Light & Water Company, with capital of \$50,000. Geo. D. Hollecker, R. H. Watson, H. H. Buttelman, E. P. Baldwin and others, are the incorporators.

OGDEN, UTAH.—The consolidation of the Ogden Rapid Transit Company and the Logan Rapid Transit Company which has been agitated for so long has been consummated and articles of the incorporation of the new company to be known as the Ogden-Logan & Idaho Railway Company, were filed recently with the county-clerk of Weber county. The new company is capitalized for \$5,000,000 which is five times the combined capitalization of the two companies entering into the merger. It is announced that the additional capital will be expended in the near future in several important extensions including 44 miles of line between Logan and Brigham City which will connect together the two said systems, 21 miles between Logan and Preston, Idaho, and 6 miles between Idlewild in Ogden Canyon and Huntsville. The estate of the late David Eccles who prior to his death was the moving spirit in both of these companies holds a controlling interest in the new company. The incorporators, officers and board of directors of the Ogden, Logan & Idaho Railway Company named in the articles of incorporation, are: M. S. Browning, president; L. R. Eccles, first vice-president; R. B. Porter, treasurer; Royal Eccles, secretary; D. C. Eccles, A. P. Bigelow, W. H. Wattis, A. T. Wright, H. H. Spencer, and Joseph Scrowcroft, second vice-president, all of Ogden, and Mariner S. Eccles, Joseph Quinney, D. C. Budge, Joseph Howell, and H. E. Hatch, all of Logan, directors. P. D. Kline, who is not a member of the board of directors, is named as general manager.

FINANCIAL.

AZUSA, CAL.—The election for \$55,000 light and water bonds has resulted in victory for the bonds after one of the most bitter fights ever held in the city.

ESCONDIDO, CAL.—An ordinance has been adopted by the board of trustees authorizing the issuance of bonds in the sum of \$100,000 for a water system. The bonds will bear date of July 1, 1913, bearing interest of 5 per cent, payable semi-annually.

ARCADIA, CAL.—Bids will be received up to November 19th, for the purchase of bonds in the sum of \$131,250, designated as Arcadia Water Bonds, 1914. The bonds will be 280 in number, 245 of denomination \$500 each, and 35 of denomination \$250 each.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company will disburse on November 1st about \$3,500,000. Aside from the \$2,500,000 which will be paid out for the redemption of notes, November 1st disbursements on account of interest will amount to \$800,000, and on account of sinking funds \$175,000.

SAN FRANCISCO, CAL.—At a meeting of the bondholders' protective committee of the Marysville & Colusa Branch Railroad, Elliot McAllister was elected chairman and W. C. Ross, vice-chairman and secretary. Beyond organizing, nothing was done. The protective committees of the Northern Electric Company and the Northern Electric Railway Company bondholders are holding regular tri-weekly sessions.

The committee representing the first mortgage bonds of the Northern Electric Company are endeavoring to ascertain from the Sloss trustees the segregated cash value of the property covered by the first mortgage, and the percentage of gross and net earnings which should be justly credited to this portion of the system.

ILLUMINATION.

SEATTLE, WASH.—The council of Port Angeles, Wash., has granted a franchise for power and light to J. L. Keeler.

SANTA ANA, CAL.—The Long Beach Consolidated Gas Company has been granted a franchise to operate a gas distributing system here.

BEAUMONT, CAL.—A contract is about to be closed with the Southern California Edison Company for installing a street lighting system in this city.

MONTESANO, WASH.—The application of L. H. Burnett and others of Aberdeen for a franchise for the operation of a gas plant in this city has been granted by the city council.

SEATTLE, WASH.—The board of public works will receive bids until November 13th for furnishing the city lighting department with one year's supply of distribution transformers.

SAN DIEGO, CAL.—City Engineer W. H. Rumsey has filed plans with the city council for the Point Loma lighting system. The plans call for 132 nitrogen lamps, each 400 candlepower.

SPOKANE, WASH.—The Washington Water Power Company has announced that it will not oppose the award of the First avenue electrolier lighting contract to the William E. Chase Engineering Company at \$66,429.

SEATTLE, WASH.—The H. E. Gleason Company has been awarded the contract by the county commissioners of Clallam County for supplying \$2000 worth of electric fixtures for the new court house at Port Angeles, Wash.

SEATTLE, WASH.—Plans are being prepared by Herbert C. Moss, White Building, for the complete electrical equipment in the \$100,000 Elks Club Building, in Tacoma, Wash., for which C. Frere Champney, Henry Building, is the architect.

MANHATTAN BEACH, CAL.—The board of trustees has awarded the contract for lighting Twenty-first, Marine, Twenty-third and Sixteenth street, to the Southern California Edison Company, for \$1.40 per month per post for single light, and \$2.40 per post for three lights.

BAKER CITY, ORE.—Steps preliminary to the calling of a special bond election for the raising of funds by the city to increase the scope of the municipal lighting plant by providing for municipal lighting of homes and business houses as well as of streets have been taken by the city commissioners.

FRESNO, CAL.—Mayor Snow postponed at the last trustee meeting any discussion of his overhead wiring policy on the grounds that the plan is not feasible at this time and discussion of the installation of the new electrolier system was postponed by request of P. H. Harwood, secretary of the Merchants' Association. A sample electrolier has been installed in front of the city hall.

RICHMOND, CAL.—Petitions are in circulation by citizens who have organized to protest against the maintenance of what they assert is an exorbitant gas rate when compared with that of other cities of the State. The petitions are addressed to the City Council and are designed to induce that body to authorize the city attorney to summar-

ize the gas rate situation and go before the State Railroad Commission, ultimately, to seek relief.

SPOKANE, WASH.—The Washington Water Power Company is installing the 38 arc lamps which will light the streets between Washington and Post under the tracks of the railways. Eight lamps will be installed at each viaduct with the exception of Howard street, where there will be 10, and Post street, where there will be three. Two electric signs, each containing 500 lamps, will also be installed on top of the grain sheds at Howard street and at Washington street.

PASADENA, CAL.—A proposition is being considered for joining Pasadena and South Pasadena in an ornamental lighted way along South Fair Oaks avenue from Oneonta park to Green street. This will involve important changes in plans already made for an ornamental lighting system from Dayton street to California street, Pasadena. South Pasadena is planning to install a system of ornamental posts with one light 400 candlepower on both sides of South Fair Oaks avenue from Columbia street to Huntington Drive.

CALIPATRIA, CAL.—The Holton Power Company turned the electricity on at Calipatria recently and the whole town is brilliantly lighted. The largest transformer plant in the valley is located at this point and the longest transmission line in the world is now furnishing power and lights to all points in the valley. As Calipatria buildings are all arcaded and the lights on the same are uniform, the main street is as light as day, and the town was full of people from the surrounding country to help celebrate the turning on of the lights for the first time.

PORTLAND, ORE.—The city commissioners authorized Municipal Purchasing Agent Wood to advertise for bids for the installation of an electric lighting system in Columbia Park. The park at present is dark at night and is said to be considerable bother to the Police Department. The purchasing agent also was instructed to advertise for bids for the remodeling of the lighting system in Peninsula Park, the system there now being out of date and inadequate. It is proposed to have the work completed in time for use of the systems next summer.

LOS ANGELES, CAL.—As a part of the plan for beautification for 1915 the Finance Committee of the City Council has had in mind a scheme for the outlining of the front of the City Hall with incandescent electric lights. City Electrician Manaban was requested to make an estimate of the cost, and this was submitted recently. The total cost is estimated at \$2650 for the installation and \$85 per month for current and maintenance. This is considered too steep, in view of the city's present financial condition, and the Finance Committee has compromised on a plan for the placing of the recently-acquired city seal, worked out in colors, on the City Hall front, and its nightly illumination until 11 o'clock. A plan has been made for the outlining of the front of the new Hosfield building, in which many city departments will soon be housed.

TRANSMISSION.

THOMPSON FALLS, MONT.—The Thompson Falls Power Company has applied for a right of way for the Coeur d'Alene transmission lines through several sections of several townships.

SEATTLE, WASH.—The Puget Sound Flour Mill, at Tacoma, has discontinued the use of steam in its plant and is substituting electricity instead. The Puget Sound Traction, Light & Power Company will furnish the current.

SAN DIEGO, CAL.—The Escondido Mutual Water Company has made application to the board of supervisors for a franchise to build an electric transmission line from the reservoir on San Luis Rey River to Escondido is the company's plan to generate power at the damsite and convey

same to consumers in and about Escondido. Work has begun on the power stations.

GOLDFIELD, NEV.—F. B. Mechling, district superintendent of the Nevada-California Power Company, was in Tonopah recently in regard to the new power line between Tonopah and Belmont for new milling and mining company to begin operations in the old camp about the first of the year. Chas. Wyckoff is the contractor. The work covers about 14 3-10 miles.

WOODLAND, CAL.—Deeds for 18 rights of way near Merritt Island, below Clarksburg, have just been filed here by the Great Western Power Company, showing beyond a doubt that the power company will include Yolo county in its territory. As the residents in reclamation district 150, which includes 7000 acres of some of the richest land in the county, are without power service at the present time and have been clamoring for electricity for years. The advent of the power company is heralded with much pleasure by the river farmers.

TRANSPORTATION.

SEATTLE, WASH.—The council passed an ordinance authorizing the P. S. T. L. & P. Co. to construct a freight spur from Latona avenue and E 65th street to block 87, Woodlawn addition.

SAN FRANCISCO, CAL.—That the Potrero and Van Ness avenue municipal railway will receive better patronage if the cars are routed east on Geary street to the ferries is the opinion of the Mission Promotion Association.

SEATTLE, WASH.—The Puget Sound Electric Railway Company, operating the Seattle-Tacoma interurban line, in its annual report for the fiscal year ending June 30, 1914, shows a loss of \$148,513.92. The operating expenses for the year were \$363,337.36, as compared to \$387,770.40 for the previous year.

OAKLAND, CAL.—Deeds filed with County Recorder Bacon show that the Oakland, Antioch & Eastern Railway constructed its roads on a right of way and franchise granted to the Oakland and Bay Shore Railway in June, 1911. The grantees had insufficient funds to carry on the work, it is explained, and the Oakland, Antioch & Eastern took up the franchise. The deeds are dated March 14, 1912. Samuel Naphthal was president of the first named concern.

BERKELEY, CAL.—In an answer filed in the U. S. District Court the municipal officials of Berkeley, who were recently temporarily enjoined by Judge Dooling from preventing the operation of the Key Route trains, state that even if paving work is done on Grove and Adeline streets—which was the cause of the trouble between the company and the officials—they intend to stop "trains" running on Shattuck avenue and Adeline street, where the company only has a street car franchise. It is set forth in the answer that the company has no right to run trains on street car franchises.

TACOMA, WASH.—The Old Colony Trust Company of Boston trustee under the mortgage of the \$1,500,000 bonds of the Tacoma Railway & Power Company, a subsidiary of the Puget Sound Traction, Light & Power Company, has secured from the Federal Court an order restraining the city from removing trolley wires and poles of the street railway company. A similar order asked recently by the Puget Sound Traction, Light & Power Company, was denied. Controversy over the right of the street railway company to occupy the streets with its poles and wires has existed for some time and a friendly suit was agreed upon to test the question. Within a day after the bringing of the suit the council revoked the franchise of the company despite an agreement with the trustee for the bonds that the franchises would not be interfered with.

SACRAMENTO, CAL.—The visit to this city last week of officials of the Central California Traction Company, and San Francisco capitalists, has started a rumor in railroad circles

that some sort of a deal is being contemplated with the company. It is said there is possibility of the Southern Pacific Company taking over the line. This theory is strengthened by the fact that in the party was Paul Shoup, who has charge of the Southern Pacific electric roads in California. Others in the party were Herbert Fleishhacker, one of the principal owners of the traction company; General Manager C. H. Robertson, S. C. Johnson, H. Webster and Alex. L. Ehrman. Geo. W. Peltier, vice-president of the California National Bank, and one of the officers of the traction company, is quoted as saying that the visitors were merely visiting Sacramento on a pleasure trip.

TELEPHONE AND TELEGRAPH.

SAN FRANCISCO, CAL.—City officials are arranging with the telephone company for a central station in the new city hall.

SAN FERNANDO, CAL.—Work will start soon on a building for the San Fernando Telephone & Telegraph Company to be erected on Maclay avenue.

SPOKANE, WASH.—The Pacific Telephone & Telegraph Company has been granted a franchise to lay underground conduits with all necessary equipments for telephone service.

WATERWORKS.

BILLINGS, MONT.—The Valley Creek flume of the Big Ditch Company, west of Park City, will immediately be replaced by a reinforced concrete siphon. The cost is estimated at \$7500.

HAILEY, IDAHO.—On November 10 an election will be held here on a bond issue of \$35,000 for the purpose of purchasing the waterworks system owned by the Idaho State Life Insurance Company.

RED LODGE, MONT.—The city council has voted to repudiate the contract entered into last spring for the sale of the \$30,000 issue of waterworks bonds to White, Grubbs & Company of St. Paul.

GREENVILLE, CAL.—The 200 men who were employed by the Great Western Power Company, on the Canyon Dam, at Nevis, have been discharged. The big barrier has been completed, and only an operating crew is being held there.

BILLINGS, MONT.—A possible solution of the local water bond problem, which may result in the immediate floating of the \$450,000 issue, has been proposed to Mayor Leavens and if the plan is legal the bonds will be floated at once.

SAN DIEGO, CAL.—Specifications for the construction of a filtration house and tanks on the lower Otay dam have been filed with the city council. Bids will be advertised in a few days. The sum of \$60,000 was set aside in the water bond issue for this plant.

SAN DIEGO, CAL.—With the council's sanction Superintendent R. R. Fay will proceed to carry out all improvements to the water system contemplated, including the installation of the Bonita pipe line and the La Mesa line to connect the Cuyamaca system with that of the city.

OAKLAND, CAL.—It is reported that the validity of the Spring Valley Water Company's claim to the waters of the Calaveras and Sunol district is about to be attacked in the courts of the State by the landowners of that large area along the banks of Alameda Creek known as "the Niles cone."

PASADENA, CAL.—At the request of Commissioner Salisbury of the department of public utilities, Chief Engineer Morris of the municipal water works has outlined a plan for the improvement of a distribution system on several streets that are about to be paved. Four and six inch mains will be laid.

LOS ANGELES, CAL.—Wm. Mulholland's plan for the immediate construction of the Chatsworth-San Fernando line of conduit has been approved by the water board. The line will carry aqueduct water from the San Fernando dam to

the proposed Chatsworth reservoir, a distance of 45,000 feet, at an estimated cost of \$7 per foot.

CALEXICO, CAL.—Only one bid was received for the construction of a filter bed and it was rejected, as it did not include a cleaning system. H. W. Blaisdell, patentee of the filter cleaner in use at Yuma, failed to hand in a sealed bid, though he made a verbal bid of \$11,000 to the city trustees some time ago.

SAN DIEGO, CAL.—L. L. Boone, claimant of water flowing into San Diego River near Cape Horn, has offered to sell lands in the El Monte Rancho, west of what is known as Cape Horn, on the south bank of the San Diego River, about 5 miles up stream from the railroad bridge at Lakeside. The lands are water bearing, and a fine dam site is located on them. It is estimated a dam could be built for \$66,000 and a steel pipe line with a capacity of 10,000,000 gallons daily could be built for \$290,400.

LOS ANGELES, CAL.—Jos. B. Lippincott, consulting engineer, has submitted a preliminary report to landholders of Victor valley and members of the Victor Valley Mutual Water and Power District Association. Lippincott now has a corps of surveyors at work in Victor valley getting figures on the amount of land that can be formed into this irrigation district with water available. When the survey is complete figures will be submitted to the reclamation bureau to determine whether or not the project is feasible.

LOS ANGELES, CAL.—The board of public service commissioners have laid down a program for the extension of the municipal water system into territory now served by Union Hollywood Company. The district to receive city water first is that between Western and Vermont avenues and Temple street and Wilshire boulevard. The new plans indicate the paralleling of private mains and will extend all over Hollywood district. The invasion of that territory may result in the resumption of negotiations for the sale of the Union Hollywood Water Company's system to the city.

SAN FRANCISCO, CAL.—Percy V. Long, City Attorney, and A. T. Vogelsang, Supervisor, addressed the members of the Down Town Association at their last weekly luncheon, explaining the plan under which the city officials hope to be authorized to purchase the properties of the Spring Valley Water Company at a price of \$34,500,000, thus obviating the necessity for long and expensive condemnation proceedings. Long said that it was absolutely essential to the successful carrying out of the city's plan of municipal ownership and operation of its water system that the Spring Valley reservoir sites be acquired, since they are the only ones available, and reservoirs will be necessary to store water for emergencies even after the completion of the Hetch-Hetchy system. The acquisition of the Spring Valley system, he said, would enable the city to develop the Hetch-Hetchy supply consistently, and only as needed, distributing the cost of construction over many years and saving in bond interest the larger part of the cost of the Spring Valley system. The only item in the price agreed upon by the city officials and the company which is questioned by the opponents of the purchase, he declared, is an allowance of \$2,500,000 above the actual value of the physical properties for "going concern" valuation. That the courts would certainly allow as much as this in condemnation proceedings was, he said, assured by recent ruling of the U. S. Supreme Court. Supervisor Vogelsang declared that the proposal was the fairest the city had yet received for the purchase of Spring Valley, the city being required to purchase only such land as was water-producing. He said that the 68,000 acres which the city would acquire constitute a territory three times the size of the total area of the city and county of San Francisco. Speakers chosen from the opponents of the proposed purchase will present their arguments to the downtown business men at their luncheon next Wednesday.

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SAN FRANCISCO, NOVEMBER 7, 1914

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BY F. B. DUNN.

THE TELEPHONE PLANT IN RELATION TO FIRES.

BY W. D. SCOTT AND G. P. NOCK.

STANDARDS IN SAN DIEGO.

BY L. M. KLAURER.

FACTS FOR SETTLERS.

THE PURPOSES OF NATIONAL FORESTS AND THEIR PROTECTION.

BY CHARLES H. FLORY.

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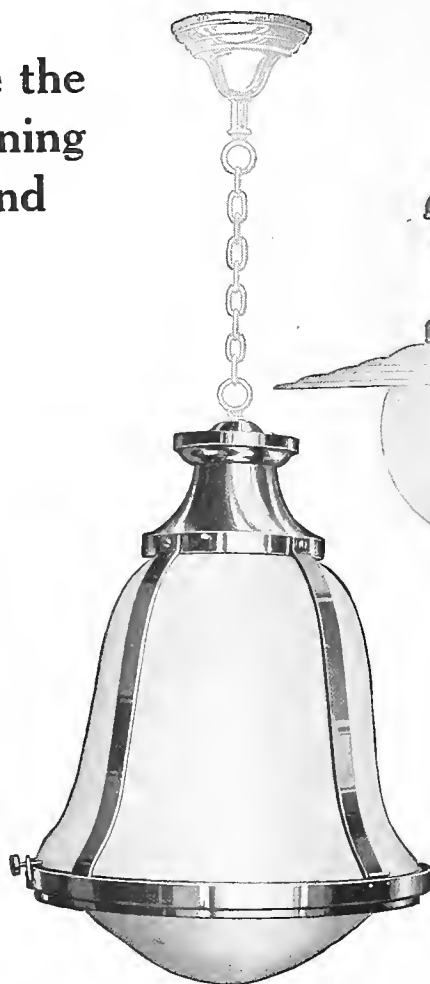
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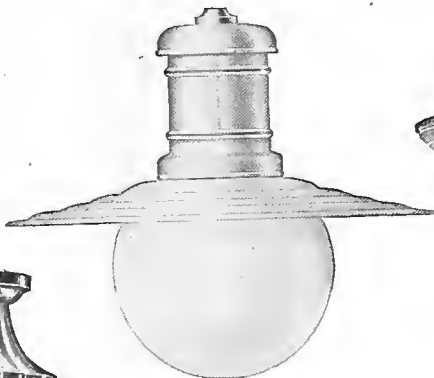
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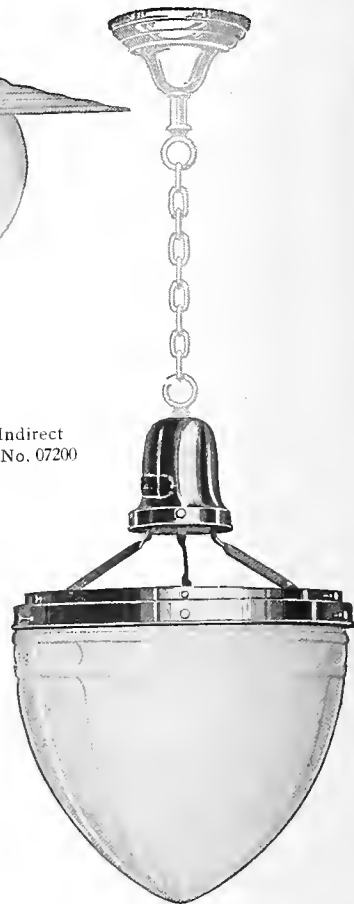


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INDUSTRIAL USES OF FUEL OIL

BY F. B. DUNN.

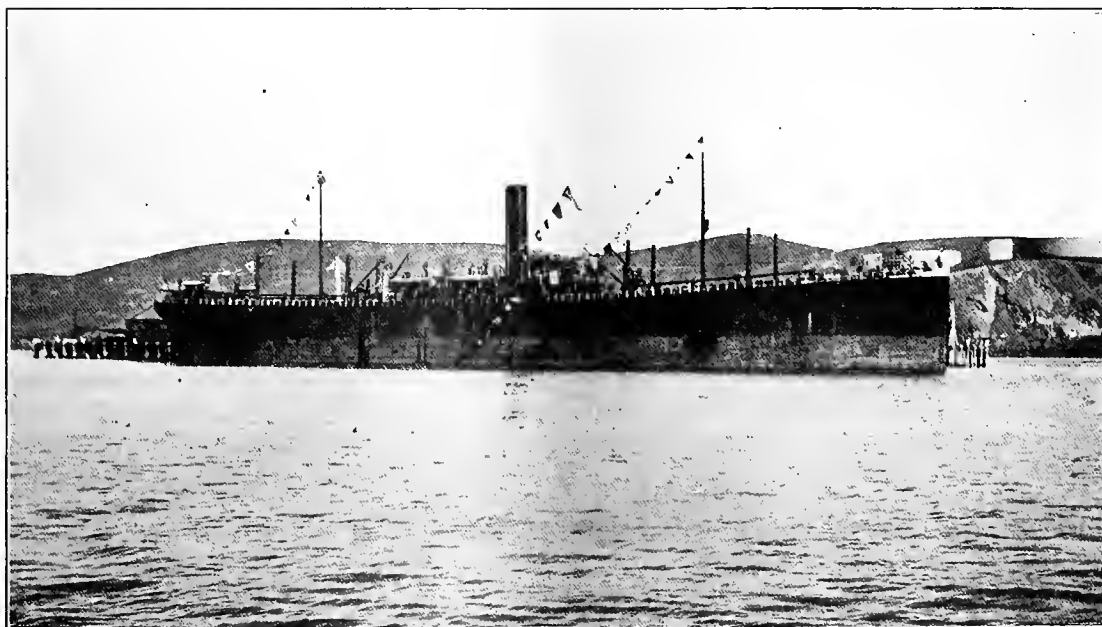
(This article is the first of a comprehensive series which will deal with all phases of the application of fuel oil to industrial purposes. This installment gives a brief introduction to the subject and presents details of approved methods of oil storage—The Editor.)

Oil as a Fuel.

The use of oil as fuel has been a remarkable development of the past few years. After carefully investigating the source of supply, both the older oil fields that have long been producing as well as the newer fields, such as those in Mexico, together with the possibilities of finding oil in Central and South

cheap fuel. The large oil storage tanks that have been erected through the country, insure to the industrial manufacturer also, a steady and regular supply of fuel oil.

These vast storage tanks, the many oil tank cars operated by the railroads, the numerous tank steamers carrying the oil to all parts of the world, and the new



A Fuel Oil Tank Steamer.

America, the navies of the world have decided to adopt oil as fuel for part of their fleet, at least. With the erection of large oil storage tanks throughout the important seaports of the world the steamship companies also do not now hesitate to equip their steamers for burning fuel oil.

The opening of the Panama Canal will change the old established routes of many steamship lines and fuel oil from the California, Mexican and Central American fields can be obtained at an attractive figure at the Canal. Thus steamers operating from New York or European ports, through the Canal to Pacific or China ports, will be able to take advantage of the

oil fields have eliminated any question as to an adequate supply.

The use of fuel oil is now well established, and new uses are being discovered daily. The question of cheap transportation of this valuable product has been solved by the large tank steamers, some of which carry over 120,000 bbl. of oil. When the authorities decide the rate question of transporting oil by tank cars and pipe lines, a still lower price will probably prevail.

Some crude oils are suitable for fuel in their natural state, for others lighter gases must be distilled. Most of the fuel oil sold has been refined, being the

residue from the crude petroleum after the more valuable ingredients have been taken out and much of the sulphur removed. The calorific value of the fuel oils from the different countries varies but little from 18,500 B.t.u.

In figuring the comparative value of fuel oil and coal the steam engineer usually compares the amount of water evaporated by unit weights of oil and coal; the electrical engineer figures the kilowatt hours produced with each pound of fuel, while manufacturers are interested in the equivalent value of a barrel of oil, compared with a ton of coal, a cord of wood, or a thousand cubic feet of gas. On account of the widely different heating values of various fuels, it is difficult to prepare a table showing exactly the equivalent value of one barrel of oil. The following table affords a rough comparison between coal fuel under similar conditions of boiler loading.

TABLE I.

Fuel—	Coal.	Oil.
Gravity of oil, Baume		16.2°
Per cent of moisture in fuel.....	3.9	1.5
Per cent of ash.....	17.87	
Calorific value, by Parr Calorimeter, per pound of dry fuel, B.t.u.....	11,811.	18,099.
Boiler Horsepower—		
Horsepower developed, A. S. M. E. rating	\$32.3	241.
Builder's rated horsepower.....	700.	200.
Per cent of builder's rating developed..	118.9	120.
Economic Results—		
Water apparently evaporated under actual conditions per pound of fuel...	7.118	13.12
Equivalent evaporation, F. & A., 212° F. per pound of fuel.....	9.0767	15.11
Same per pound of dry fuel.....	9.4451	15.34
Same per pound of combustible.....	11.83	15.34
Efficiency—		
Efficiency of boiler.....	\$2.76	\$1.8
Per cent of steam generated used by stoker	5.8	
By burner		3.58
Analysis of Dry Gases by Volume—		
Carbon dioxide	7.82	14.6
Oxygen	7.50	1.2
Carbon monoxide .....	.13	.00
Nitrogen	84.55	84.2
Per cent of excess air above amount theoretically required	50.	5.6

It has been common practice to estimate four barrels of oil equal to one ton of coal, but that this is not always the case is proved by the following test. Under a boiler one pound of coal evaporated 7 lb. of water from and at 212 degrees F., and one pound of oil evaporated 15 lb. of water from and at 212 degrees F. The rates of evaporation per pound of fuel were in the ratio of 7 to 15; and as the coal weighed 2000 lb. per ton and the oil 330 lb. per barrel, one ton of coal was

$$\text{equivalent to } \frac{2000 \times 7}{330 \times 15} = 2.828 \text{ barrels of oil. On}$$

the other hand, a good grade of coal may have 14,500 B.t.u. per pound, while oil averages 18,500 B.t.u. per pound. The theoretical equivalent of one ton of coal

$$\text{in this case is } \frac{2000 \times 14500}{330 \times 18500} = 4.75 \text{ barrels of oil.}$$

These cases may seem extreme, but they indicate the danger of using "rules of thumb" in making preliminary calculations of fuel consumption. The writer has seen many cases in which a contractor has failed to meet his specifications, simply because he took it for granted that four barrels of oil were the equivalent of one ton of coal.

It is equally difficult to compare the heating value of a cord of wood with that of a barrel of oil. The heating value of the wood in question must be known, as well as the percentage of water that it contains, before making a comparison with oil fuel.

The type of furnace in which the oil is to be used is an important consideration in making any comparison with other fuels. Assume, for example, a furnace which has an efficiency of 76 per cent when burning coal. If, upon converting this furnace to an oil-burner, it has an efficiency of 83 per cent, the amount of oil required will be less than the amount indicated by a comparison of the heating values of coal and oil. As a rule such an improvement in efficiency may be expected from the conversion of a coal burning to an oil burning furnace, provided the installation is made by a competent oil expert. This is partially due to the higher furnace efficiency inherently attainable with fuel oil. But a more important cause lies in the fact that the average plant using coal as fuel is attended by an unskilled fireman, who can only get the best results from coal by hard work, close attention, and intimate knowledge of the coal. Often he does not understand the most efficient method of firing the coal or regulating the draft, and as a result a great deal of fuel is wasted. This point is clearly brought out when a coal or boiler expert is brought in to conduct a test; much higher efficiencies are invariably attained.

Conditions are very different in a plant using oil. The work of firing requires no physical exertion; a clear eye and common sense is all that is required. The fireman has plenty of time to see that the burner is working properly and that a uniform amount of feed water is being supplied; and by watching the stack he can prevent some of the fuel losses that take place if smoking is permitted. Also, when using fuel oil a much better class of labor can be secured; this has been clearly proven on board ocean going steamers.

The writer can remember the time when it was almost impossible to secure firemen on a certain steamer, and many that were secured were unfit for work during their first watch, three watches being often required to get them in good working condition. It was laborious, hot work, as the steamer was running to the tropics. The firemen usually made but one voyage and a new crew had to be obtained each trip. This vessel is now using fuel oil, and I have been informed by the engineers, that they seldom make a change in the fire room crew.

Purchasing Fuel Oil.

With the supply of oil fuel assured, the question of greatest interest to the engineer is how to buy it. The price of the oil must of course be low enough to warrant making the fuel oil installation. And the time for which this price is guaranteed in the fuel oil contract should be long enough to enable the consumer to save on his fuel bill at least the cost of making the oil installation.

The analysis of crude and fuel oils varies with the wells or countries from which the oil is obtained. The characteristics required by the purchaser should be embodied in a contract; a good commercial fuel oil should be of the following specifications:

Specific Gravity at 60° Beame.....	Not less than 14°
British thermal units.....	Not less than 18,500
Water	Not over ½ %
Sulphur	Not over 2 %
Dirt, sand, etc.....	None
Flash point.....	Not lower than 140° F

Before making the fuel oil installation, a fuel oil expert should be engaged. He should be familiar with the rules and regulations regarding the location of oil storage tanks enforced in the particular locality by the inspectors, fire marshal and insurance officials. These regulations vary greatly in different states and countries. The accompanying illustrations taken from the official San Francisco Fire Department ordinances, will serve to give the reader an idea of the regulations for the installation of fuel oil storage.

Fig. 1 shows boiler in basement, the sidewalk being excavated and used as part of basement and the owner desiring to utilize all the space under the sidewalk for basement purposes. The top of the storage tank should be 4 ft. below the basement floor; a brick or concrete wall not less than 12 inches in thickness should be constructed around the storage tank, ex-

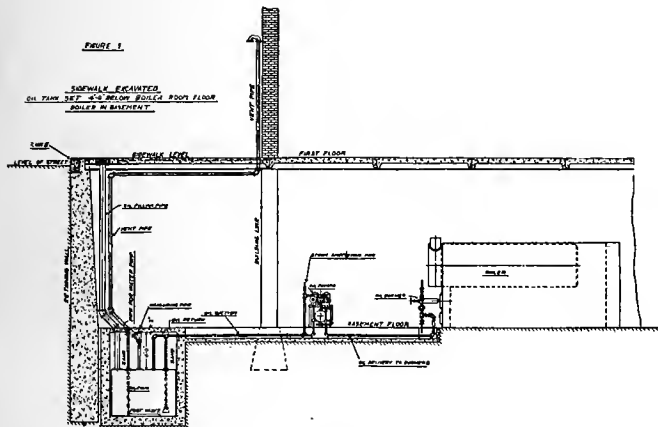


Fig. 1.

tending from the bottom of the tank up to the basement floor. The space between the top of the tank and the basement floor should be filled with earth and the earth covered with the concrete flooring of basement. Flooring at the bottom of the tank is optional.

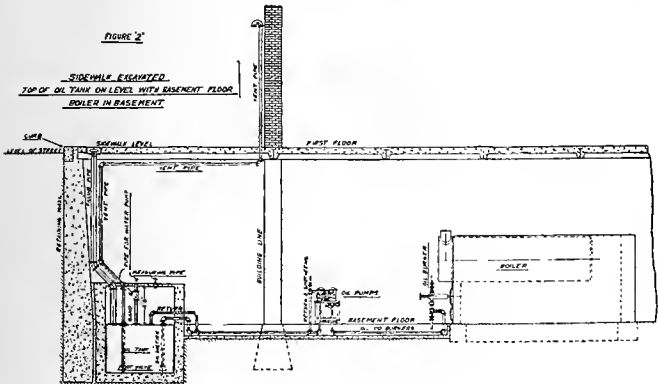


Fig. 2.

Fig. 2 shows boiler in basement, the sidewalk being excavated and used as part of basement and the owner finding he cannot go over 4 ft. below the basement floor. The top of the storage tank should be at least 6 in. below the basement floor, a brick or concrete wall not less than 12 inches in thickness

should be constructed around the storage tank, extending from the bottom of the tank up to 4 ft. above the storage tank. The space between the top of the walls should be filled with earth, the earth covered with at least 3 in. of concrete. The flooring at bottom of tank is optional. All oil pipes exposed in building should be fire-proofed, or under the concrete flooring from the tank to the pump.

Fig. 3 shows boiler on the first floor, no basement, sidewalk not excavated. The top of the storage tank should be at least 4 ft. below the sidewalk; a brick or concrete wall not less than 12 in. in thickness should be constructed around the storage tank, extending

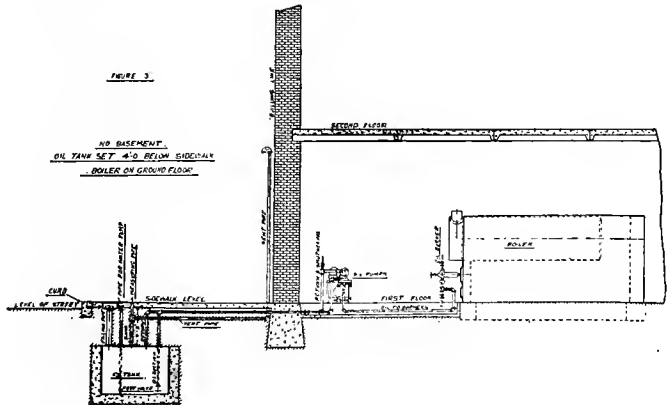


Fig. 3.

from bottom of tank up to top of tank. The space between the top of the tank and the sidewalk should be filled earth covered with the sidewalk. Flooring at bottom of tank optional.

Fig. 4 shows boiler in basement, sidewalk not excavated. Top of the storage tank should be at least 6 in. in thickness. A brick or concrete wall not less than 12 in. in thickness should be constructed around

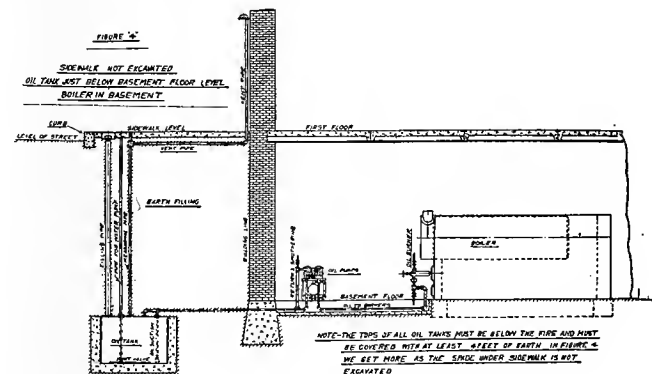


Fig. 4.

the storage tank, extending from bottom of tank up to top of tank. The space between the top of the tank and the sidewalk should be filled with earth, the earth covered with the sidewalk. Flooring at bottom of tank optional.

All tanks should be of steel construction, thickness of plates as follows: Up to 5000 gallons, 3/16 in. shell; 5000 to 10,000 gallons, 3/16 in. shell, with 5/16 in. heads; 10,000 to 20,000 gallons, 1/4 in. shell, with 3/8 in. heads. Over 20,000 gallons tanks must be of standard specifications for oil tanks.

(To be continued.)

THE TELEPHONE PLANT WITH RELATION TO FIRES.

BY W. D. SCOTT AND G. P. NOCK.

(This interesting description of how the telephone companies prepare against fire is to be presented before the joint meeting of the Portland A. I. E. E. and N. E. L. A. Sections on November 10, 1914. The authors are connected with the Pacific Tel. & Tel. Co. at Portland.—The Editor.)

In the ordinary life of a community there is probably no one thing that will bring out a crowd, at any time of day or night, as will a fire, and I think it is safe to assume that everybody has a dread of fire, not only because of the financial losses that it causes, but from the dangers involved and the tremendous uncertainties which are always present.

In presenting this paper to you it is our idea that there are certain relations between the telephone industry and fires that are not to be found in other lines of business. The widespread territory covered by the

whatever, will often do a large amount of damage, not only to the plant itself, but to the entire community, as the latter may find itself without telephone service for hours or even days, and in these modern times telephone service has ceased to be a luxury, and is now a business necessity.

The telephone company has its own particular fire hazard. There is not only the fire hazard of the plant itself, but because of its distributed nature, reaching as it does over an entire community, serious damage may be caused through a fire hazard for which the telephone company is in no way responsible and can in no way abate.

Reaching out from its central offices is its distributing system of wires and cables. In the more congested districts of the larger communities and wherever it is commercially possible to do so, the wires of the telephone companies have been placed under ground. In the residence districts and in the outlying portions which are thinly settled we are, as yet, unable to place our wires under ground except at an expense which would make the cost of telephone service prohibitive. The type of aerial construction which is now placed on poles is vastly superior to that which was in vogue several years ago. No longer do you see the high pole, 60 or 70 or 100 ft. high, filled from its top almost to its bottom with crossarms and carrying possibly 100 or more separate wires. Today the high pole lead has been replaced by a short one and all the separate wires have been grouped together and placed in cable. In this way many risks of fire and damage by foreign electrical currents have been obviated.

Even now, in a city there is always a possibility that the wires of the signal company, such as the telephone company, may become crossed with power wires. Such an accident may result in a current of electrical energy many times larger than telephone current being carried by the telephone wire. Without some adequate means of protection this electrical current may be taken in the buildings of the customers or into the central offices of the telephone company.

Protective System.

At each subscriber station where there is any possibility of a connection being established between the wires of the telephone company and the wires of the power company, a protective device is installed to operate automatically in case the wires of the telephone company should ever carry any excessive amount of current. At all of the junctions between aerial and underground cables similar protective devices are placed in order that the line may be opened by means of this protective equipment under conditions of excessive strain due to surplus quantities of electrical energy.

In the earlier years of the telephone industry considerable damage was sometimes done through lightning. Damage from this source usually occurred to plant and property of the telephone company through the destruction of instruments, cables or central office equipment. Included in the protection installed in the telephone company's premises, in their cable boxes and at the subscribers stations is a protective device which conveys to earth lightning discharges and in this way prevents damage. Inside of the central office itself, where is placed the brain of the telephone industry,



Pacific Tel. & Tel. Company's New Building at Portland.

telephone plant and the vast number of complicated circuits in the telephone companies' central offices offer a large field for damage by fire, especially from sources over which we have no control.

A very small fire in a switchboard and one which, in other places would probably be of no consequence

the entering wires or cables are equipped with protectors, which will carry to ground any electrical current that is of sufficient magnitude to damage the central office equipment or cause a fire.

The design and operation of this protective system shows to what extent the fire risk incident to electrical hazard in an extensive wire plant has been considered.

For convenience we have divided it into three groups:

First: The subscribers station.

Second: The cable plant.

Third: The central office.

At the subscribers station two fuses are provided. These fuses consist of a fibre or porcelain tube approximately 5 inches long, arranged at the ends with suitable terminals for holding the wires and containing in the center of the tube a strip of metallic alloy which will melt when the current carried by the metal strip exceeds a predetermined amount.

The wires to the subscribers' premises are attached to these fuses, either on the outside of the building or immediately inside of the building. When placed inside they are mounted on porcelain supports and all wiring is carried on porcelain insulators and well separated.

Associated with these fuses is a metal-covered porcelain block on which are mounted four small pieces of carbon. These pieces of carbon are separated by a piece of notched mica .0055 inches in thickness. Two of the carbon blocks are connected to earth and two are connected to the line wires. Under normal conditions the thin piece of mica separates the two carbons connected to the line from the two pieces of carbon connected to ground.

The air gap between the two pieces of carbon is such that a potential of 300 volts will arc across between the carbons to ground. In one of the carbons is a plug of readily fusible metal which will melt and connect the two carbon blocks solidly together. Should an excess current ground the line through the carbon blocks there is a sudden rush of current in the line and the metallic strip in the fuse melts and opens the line.

At the junction of the aerial wire and the cable plant, fuses, which are duplicates of the ones at the subscriber's station, are placed. In addition to this where the open wire is subject to lightning disturbances copper blocks separated by a thin piece of mica are installed. These copper blocks are arranged similarly to the ones at the subscriber's station, but operates a potential of 1000 volts instead of 300.

In the central office, as near as possible to the point of entrance, is placed a set of carbon blocks similar to the ones at the subscribers station and in addition a piece of apparatus known as a "heat coil."

This equipment consists of a small coil of fine wire wound over a copper shell. Inside this copper shell is a tinned copper pin held in place by solder which has a low temperature coefficient. A current of .5 of an ampere passing through the coil of wire will cause the solder to melt in less than 210 seconds. The melting of the solder will release the pin and by means of the device which holds the heat coil in place, the pin is forced in contact with a grounded plate.

The central office protection will complete a connection to earth in two ways. One, through a voltage in excess of 300 volts jumping the air gaps between the carbon blocks to ground and the other through a very small current melting the solder of the heat coil. The operation of either of these protective devices permits the excess current on the line conductors flowing directly to earth. Any sudden rush of current caused through grounding the line opens the fuses, which are placed between the aerial and underground plants or between the open wires and cabled conductors.

Constructional Precautions.

In order to still further reduce the hazard which might be caused by electrical construction of all kinds efforts are being constantly made to improve conditions and methods. A joint committee from various electrical associations have adopted specifications for "Overhead Crossings of Electrical Light and Power Lines." These specifications apply to overhead electrical light and power line crossings over railroad right of way, tracks, or lines of wires, and to overhead electric light and power wires of over 5000 volts constant potential, crossing or constructed over telephone, telegraph or other similar lines.

They set forth in detail the location and kinds of supports to be used, the clearance between wires, distance from inflammable material, the size and kind of conductors to be used, guys, clearing of spaces about supports so that they may be free from inflammable material, and many other important details. They represent the consensus of opinion of the best available engineering talent in this country as to what is considered safe construction, when it is necessary that the wires of one wire using company cross over the wires of another company or over the tracks of a railway company.

Realizing the importance of this subject, the various public service and railroad commissions have adopted rules covering construction methods which take into consideration fire risk and possible injury to employes or the general public.

In addition to this the various municipalities have their own sets of rules.

In many cities there are joint pole agreements in force between the various pole using companies. These agreements have to do with the joint occupancy of poles by more than one company. This arrangement does away with the number of poles in the streets and has led to each company placing a more substantial type of construction.

Generally the outside plants of wire using companies are being constructed at present in a more substantial manner than in the past. The various interests see that the whole public can be best served by a complete understanding as to what is required of all and are trying to furnish their own service, be it light, power, telephone or telegraph, in such a manner as to reduce the total hazard to a minimum.

Housing Apparatus.

The apparatus inside of a telephone office is complicated. Not only is this true on account of the functions which it has to perform, but further complications are introduced through limited amount of space

which can be economically used for accommodating a comparatively large quantity of equipment.

From the very nature of the equipment it is very subject to damage from water or fire.

The first essential of a central office is proper housing. The buildings must be well built, they must afford proper space for the equipment and they must be so designed as to afford ample light and air for the employees. In addition proper fire protection measures in the way of emergency exits and fire protective apparatus must be provided.

It is now generally the practice for the telephone companies to erect their own buildings in all of the larger cities. These buildings are of two classes: the so called slow burning mill type of construction or the latest type of steel frame, concrete fire-proofed construction with reinforced concrete floors.

Buildings of the slow burning mill construction type are only erected in the outlying or residential sections and are usually built with brick or reinforced concrete walls. The floors consist of timbers 2 inches in width and varying thickness from 14 inches up, spiked solidly together. These floors are supported on heavy timbers which are in turn supported by cast iron or wooden pillars.

Buildings of the steel frame type, have the steel framing fire-proofed with reinforced concrete and reinforced concrete floors. The walls are either of brick, terra cotta or reinforced concrete.

In both types of buildings exposed openings or openings adjacent to other buildings have steel sash and window frames and are glazed with wire glass.

In buildings of the steel frame type all sash doors and trim are of metal. All exposed openings, in addition to the wire glass are protected with fire shutters. These fire shutters are equipped with fusible links and will close automatically if the link becomes fused. All doors at fire and fuel rooms and entrances to cable pits are held open by means of a weight attached to a fusible link. These doors will close by gravity if the link is fused.

Exterior and interior stand pipe systems are installed. The interior stand pipe system is equipped with a fire hose and nozzle at each floor and where a high pressure system of street mains is provided the interior stand pipe system is connected to this system of high pressure mains.

Where it was thought that the pressure of the water system will not at all times be sufficient to meet all emergencies, a direct connected, motor driven centrifugal pump is placed in series with the standpipe. An automatic controlling and motor starting device is associated with the motor so that the motor will start if the water pressure falls below a predetermined amount. Another safeguard is provided in this system. Should the water fail, the stand pipe is carried to the street where a connection can be made to a fire engine. An automatic check valve prevents the engine from forcing water back into the mains.

All elevators are enclosed in a fire-proof elevator shaft with tight doors. The doors themselves are of steel and where glass is provided it is of the wire type.

The fire escapes are stairs of ample width with substantial landings. The exits to the fire escapes

are provided with "panic bolts" on the doors. Lights are provided on all fire escapes and these lights are placed on circuits separated from the other lighting circuits of the building.

Where electric elevators are used the leads to the motors are separated from the other electrical wiring of the building and if it should ever be necessary to cut off all of the current from the rest of the building the elevators will still be supplied.

Every effort has been made to have our buildings constructed in accordance with the best advice we can obtain in order that they may be as safe from fire risks within and without as the light of our present knowledge will permit.

Should such a catastrophe as a fire occur we have adopted every device shown to have merit in order that the lives of our employees may be protected to the utmost.

In giving these brief outlines of our building construction we have indicated what are our present methods. Time alone will tell whether or not these present methods will appear as crude in the future as our past efforts do in the light of our present knowledge.

Methods of Fire Protection.

On account of the value of service all telephone companies have taken particular precautions in connection with protection of their central office apparatus against fire.

The various pieces of apparatus can be readily damaged beyond repair by the use of a chemical fire extinguisher. It is doubtful that any more severe damage can be done in the central office of a telephone company than by throwing water on a fire in a telephone switchboard.

As you know, the general practice in all of the larger communities on this continent is to provide telephone systems of the so called "common battery type." This means that all of the signalling and talking functions are supplied with the necessary electrical energy from a common source located within the central office.

Present practice is to use a storage battery for this purpose. The voltage of this battery is seldom less than 22 volts and as far as I know does not exceed 50 volts. The quantity of current under normal conditions does not exceed approximately .1 of an ampere in any part of any one circuit. These amounts of electrical energy are so small that, provided no greater quantity ever flowed, it is probable no fire hazard would ever result.

Accidents, however, are apt to occur. It is necessary to protect the apparatus against dangerously large flows of current. Individual fuses are provided which limit the flow of current in the various circuits to quantities of 1-3, 2 or 5 amperes. These fuses are provided with a visual and audible alarm which immediately indicates to the attendant an operated fuse. Immediate attention can then be given to determine the cause of the trouble.

The switchboards themselves are constructed of steel frames over which a wood covering is placed, the wood simply protecting the interior from dust and giving a good appearance. No more wood than is abso-

lutely necessary is ever used. All of the racks for holding the wires, cables and other pieces of apparatus are of steel. The boards themselves are divided into sections by means of steel screens. Each section of frame-work is sub-divided horizontally by means of steel screens so that the sections are in three parts.

If, in spite of the automatic fuses, or in case of accident or through carelessness, a fire should start in any particular switchboard section, the remaining portion of the switchboard and in fact the remainder of the particular switchboard section is cut off from fire damage by means of these screens.

It is generally necessary to run wires and cables from one floor to the other. In such locations a hole through the floor is necessary. Where such a hole is placed it is faced with steel and after the wires have been placed is closed completely by means of boards constructed of asbestos and cement.

Fire Fighting Apparatus.

For fire fighting purposes there is installed in every central office four different kinds of fire fighting apparatus: First, a pail filled with sand; second, an asbestos blanket; third, a fire extinguisher called a "dry gas fire extinguisher"; fourth, the well-known portable chemical fire extinguisher, (our last resort).

After providing all the various methods for protection against a possible fire without an adequate and carefully supervised system among the employes, without training them as to what to do in case of an emergency, the provision of this equipment, would be of little value. So that all our employes may know the uses of the fire protective apparatus, and be familiar with the steps to be taken in case of fire, complete instructions, including a system of fire drills have been issued.

An electrically operated fire bell system is provided for the notification of all employes that there is a fire. Immediately upon the sounding of the fire signal the operators leave their switchboards and march directly to a building exit and down the street. Various signals indicate what particular exit or groups of exits shall be used.

A diagram of each floor of the building is provided, which shows the various exits and line of march to be taken by the employes. The employes familiarize themselves, not only by looking at the diagram, but by actual participation in the fire drills as to best way to leave the building. We have the employes leave their work and leave the building. It was thought at one time that the nature of telephone service, particularly in the middle of the day when there was a large volume of business, was such that it would be impractical to give up the telephone service for a sufficient length of time to allow our employes to get to the ground and back again. We have now had this fire drill plan in operation for some months and have not experienced any serious service complaints. Generally the customers upon being advised of the reason for delay have been satisfied.

Regular stations, such as fire fighting equipment, fire escapes and other important points are assigned to the male employes, who go directly to these stations immediately upon the sounding of an alarm.

The duties of the various employes have been carefully studied and assigned so that there are em-

ployes to look after the fire doors and shutters, to look after the fire extinguishers, to assist in every way in the safety of the employes, to preserve discipline and to see that the various parts of the drill are carried out expeditiously and without disorder.

Over the top of the switchboard is a waterproof cover and an employe is assigned to see that this cover is pulled over the board should occasion ever be necessary. Other employes are to see that office records are properly removed, and still other employes take up locations at the fire escapes.

It is the duty of the particular man in charge of any one office to see that the city fire department is immediately notified in event of fire at any point of the telephone company's premises.

General hints in connection with fire protection, such as refuse, stoves, furnaces and oil and other combustible materials are also contained in the instructions.

In compiling these instructions and making them effective we have had several conferences with various fire marshals and fire chiefs in cities where this plan is in vogue. In every case we have received a hearty endorsement and not only have the various fire chiefs taken considerable interest in our plan, but have rendered us material assistance through many valuable suggestions which they have made in connection with the provisions of adequate exits, the matter of seeing that fire doors can be readily opened by means of panic bolts instead of ordinary door knobs, the provision of adequate and safe fire escapes, and many other points. They have also learned that water is the last thing to be turned on in a telephone office.

These precautions are not necessary on account of telephone operating equipment representing a fire hazard. On the contrary fire insurance companies regard telephone buildings and their contents as a desirable risk. They are necessary because of the value of uninterrupted service to the public.

The safety of our employes, the complicated nature of the mechanical construction, the ease with which it may be damaged beyond repair through moisture or chemicals and the ever present possibility of uninstructed effort doing more harm than good, have been some of our principal reasons for spending considerable thought on fire and its prevention.

Such fires as we have experienced have usually occurred during the time that an equipment was being assembled or when an addition was being made.

It is necessary that we solder wires together or to pieces of apparatus. Bees' wax heated almost to the boiling point is used to saturate the ends of the cables. Paint and oils are a necessity. Artificial light has to be used.

We surround the work with every precaution. Smoking is prohibited. Insulated guards are placed over electric lights. Where portable gas furnaces are used for heating soldering irons, the rubber hose is incased with steel wire. Oils and paints are kept outside of the building in fire-proof containers.

Fortunately so far on the 'Pacific Coast we have escaped a serious fire in any of our offices, except, of course, in San Francisco at the time of the earthquake. This cannot be said, however, for other portions of the country.

During the month of March a serious fire occurred at Worcester, Mass. This fire rendered inoperative telephone service to about 150,000 subscribers and like some of our other fires we have never been able to determine exactly what caused it. The resulting damage occasioned as much work as the establishment of an entire new central office equipment. The work of repairs was completed in 9 days, and when it is known that there were nearly 20,000 telephone instruments connected to this switchboard handling over 1,000,000 telephone calls a day, the difficulty of the task which confronted the employes of the telephone company can, to a limited extent be realized by everyone. The particular building in which the equipment was located was undergoing alterations and the fire started in a portion of the building which was used by the building contractor as an office. Due to the temporary alterations which were then in progress, the fire spread rapidly to other portions of the building, which under normal conditions it would not have been able to reach.

The fire started at the time when there were few employees on duty, and through that cause gained considerable headway before it was discovered. The greatest amount of damage, however, was not done by the fire itself, but was done by the water, which was put on the burning portions of the cables. In justification of the fire department, however, there must have been upon its arrival a severe blaze in a portion of the equipment, and to one not familiar with telephone apparatus the action taken of pouring on a large quantity of water was in all probability justified.

Another aspect to the value of telephone service to a community is illustrated by what happened at Salem, Mass., during the time when Salem had its \$15,000,000 conflagration in June of this year. The central office of the telephone company was not burned, but the telephone company lost about 1000 telephones and the long-distance cable plant was badly damaged and about 25 employes were made homeless.

A common desire to do everything possible for the benefit of the telephone using public, supplemented by a loyalty to the company that characterizes their work everywhere in great emergencies, was the spirit that dominated these employes and resulted in widespread commendation.

The faithfulness and heroism of the operators was remarkable. What they did in those trying hours during the fire and later makes one of the most dramatic stories of the conflagration. Their work was superb. It could not have been better. The homes of twelve operators were burned—one in every eight of the entire force of ninety-five. And yet for more than an hour these girls, with others, sat at the switchboards with coats and hats on and answered thousands of calls from excited subscribers while the great fire raged within five hundred feet of the central office and the lurid flames could be seen more than one hundred feet in the air. Although the front windows were too hot to touch, these young women remained at their work without indication of fright or nervousness. During the night they worked by the red light of the fire and lanterns after the electric and gas lights had gone out. Those who were in the operating rooms during this period and witnessed the work of these

girls pay willing testimony that every one was a true heroine of the switchboard. Many knew their homes had been burned, or were in the path of the fire, and yet they continued their nerve-racking work as though nothing out of the ordinary was happening.

It was providential that the telephone central office was not burned, for the service was indispensable during the fire in summoning help from twenty-two cities and towns and calling over two hundred militiamen and a number of state officials. After the conflagration the service was of equal value, if not more so, as a means of quick communication for those engaged in the splendid relief work.

Early in the afternoon of Thursday, when it became positive to the city officials that the fire was beyond control, the first appeal was made to the telephone company for help. In response, operators were given the names of every member of the Second Corps of Cadets and of Company H of the Eighth Regiment. They went to work immediately, and in about one hour most of the men were at the armory and ready for guard duty.

Simultaneously, other operators were sending out the call for firemen and police in various places, and it was not long before fire apparatus and officers were coming to the stricken city from all directions. During the evening the central office was visited repeatedly by fire and police officials, who sent directions out over the wires from the chief operator's desk.

It is evident from the example at Salem that in event of a severe conflagration immediate steps should be taken for the protection of telephone plant and equipment in order that at the time of the greatest need the citizens may have ready means of communication.

Thus we see the telephone plays an all-important part in the daily life of any community. It is indispensable in an emergency. Therefore, in order that it may be available when needed the most, every possible precaution must be exercised to keep, not only the telephone buildings and central office plant in working order, but the entire distributing system serving every office. It is felt that the telephone companies are doing all in their power to bring this about, and with a better knowledge by the public of the peculiar conditions which apply to the maintenance of the telephone plant and their co-operation, we believe that the highest efficiency possible will be obtained in the telephone service, and the telephone companies will be able to realize their aim, "To furnish reliable and prompt telephone service and to deal courteously with everybody."

A library of petroleum literature has been established by the United States Bureau of Mines under the direction of W. A. Williams, chief petroleum technologist. The details of this work have been assigned to Dr. David T. Day, who has recently been transferred from the United States Geological Survey as petroleum technologist, and who will also assist in a thoroughly organized research into the chemistry of oils, which is being developed by the Bureau of Mines. The importance of such a library is so manifest that it is hoped all technologists will aid in the work by exchanging with the bureau all available books and maps on this subject.

ELECTRIC DISTRIBUTION

STANDARDS AT SAN DIEGO.

Section H—Meters.

BY L. M. KLAUBER.

[Continued.]

The following items are treated in the handbook:

H 10 Dimension Sheets.

H 20 H.P. Calculations.

H 30 Test Diagrams.

H 40 Meter Constants.

H 50 Current Reading Loop.

H 10: Dimension Sheets. These drilling plans have been found of considerable use to meter setters. The schedule of meters covered is as follows:

H 10.1—Standard Watthour Meters. Sizes Used and Index to Dimension Sheets.

Single Phase.			
2-wire—110 or 220 v. Size in Amperes. Fig. No.		3-wire—110-220 v. Size in Amperes. Fig. No.	
3	1	3	2
5	1	5	2
10	1	10	2
15	1	15	2
25	1	25	2
50	3	50	4
75	3	75	4
100	5	100	5
5 round type 7		150	6
10 round type 7		5 round type 7	7
		10 round type 7	7

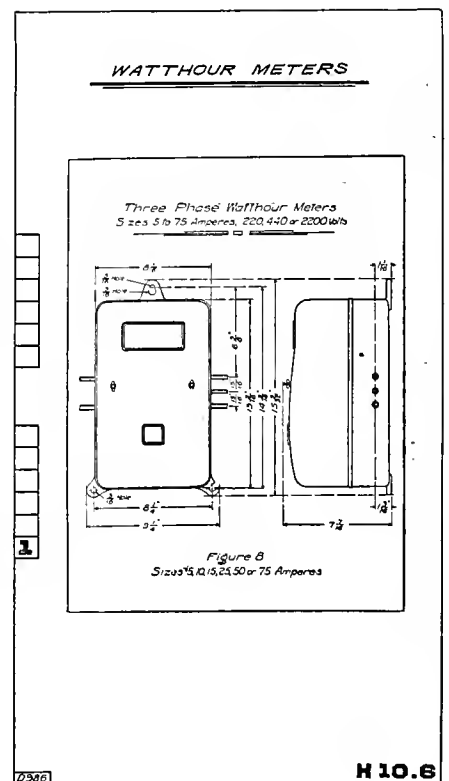
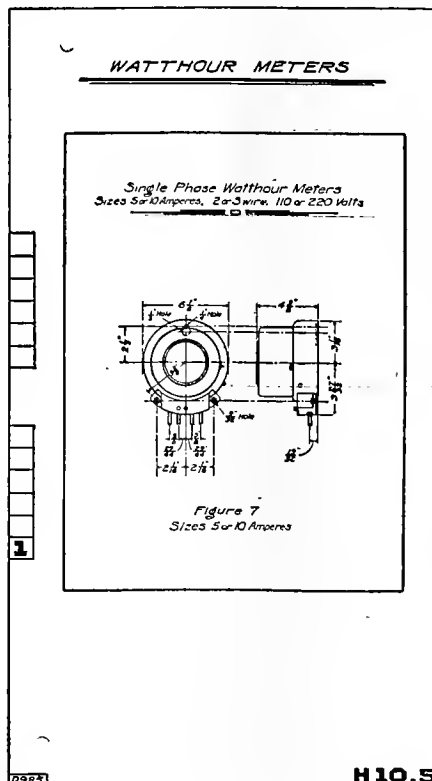
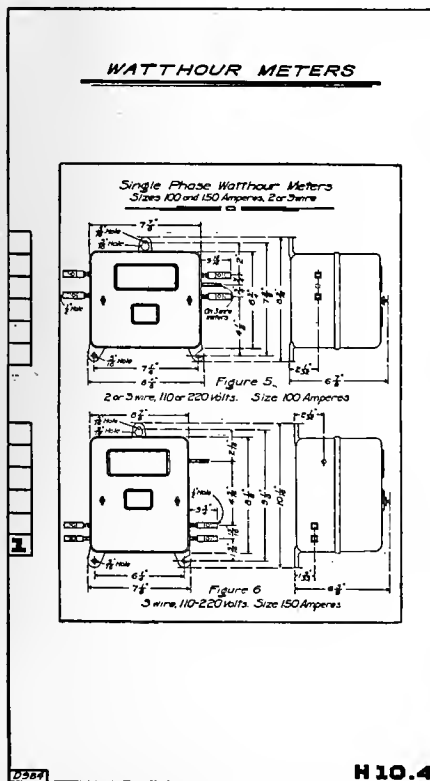
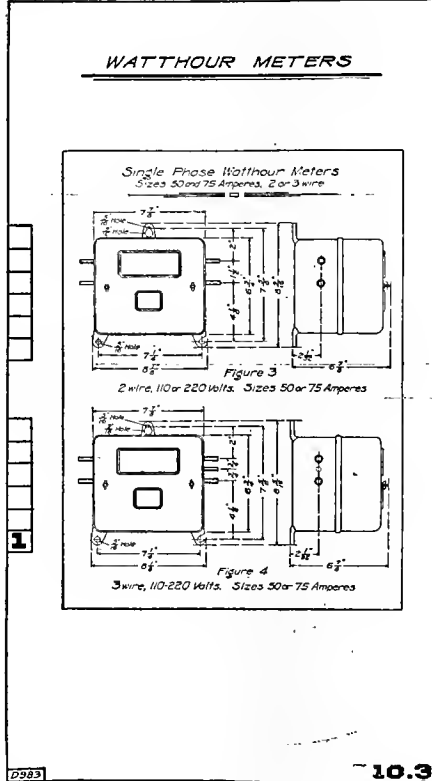
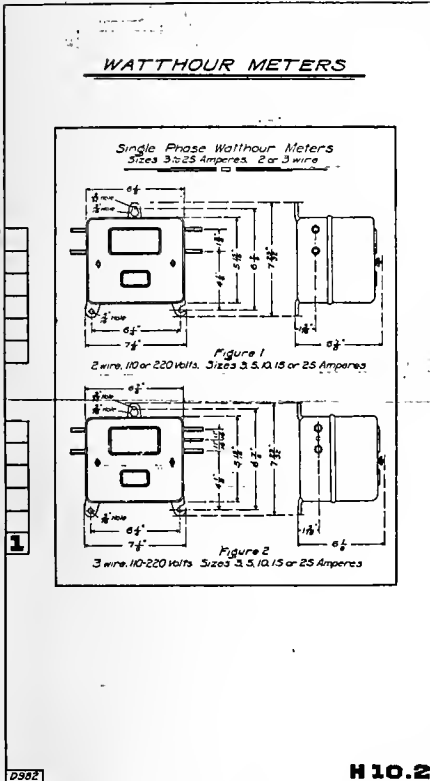
Three Phase.

3 wire—220 or 440 v. Size in Amperes. Figure No.	
* 5	8
10	8
15	8
25	8
50	8
75	8
100	9
150	9

* Also used for 2200 volts.

Direct Current.

2 or 3 wire—110 or 220 v. Size in Amperes. Fig. No.		2 wire—500 v. Size in Amperes. Fig. No.	
5	10	5	11
10	10	10	11
15	10	15	11
25	10	25	11
50	10	50	11
		75	12
		100	13
		150	13
		300	14



WATTHOUR METERS

Three Phase Watthour Meters
Sizes 100 and 150 Amperes, 220 or 440 Volts

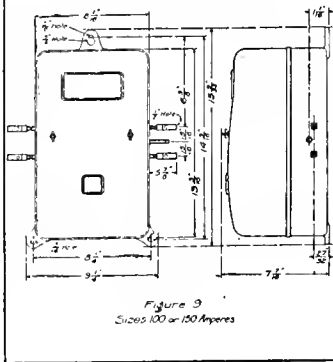


Figure 9
Sizes 100 or 150 Amperes

H 10.7

WATTHOUR METERS

Direct Current Watthour Meters
Sizes 5 to 50 Amperes, 2 and 3 wire, 110 and 220 Volts

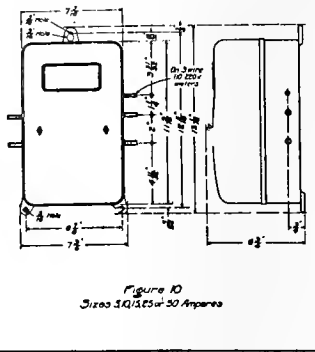


Figure 10
Sizes 5 to 50 Amperes

H 10.8

WATTHOUR METERS

Direct Current Watthour Meters
Sizes 5 to 50 Amperes, 500 Volts

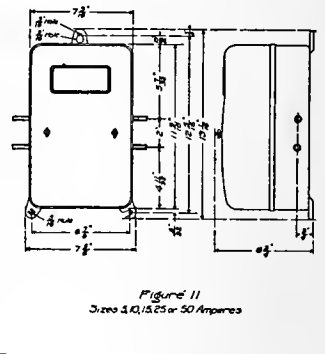


Figure 11
Sizes 5 to 50 Amperes

H 10.9

WATTHOUR METERS

Direct Current Watthour Meters
Size 75 Amperes, 500 Volts

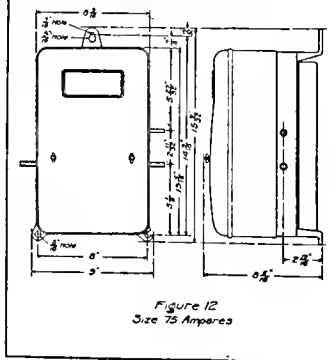


Figure 12
Size 75 Amperes

H 10.91

WATTHOUR METERS

Direct Current Watthour Meters
Sizes 100 and 150 Amperes, 500 Volts

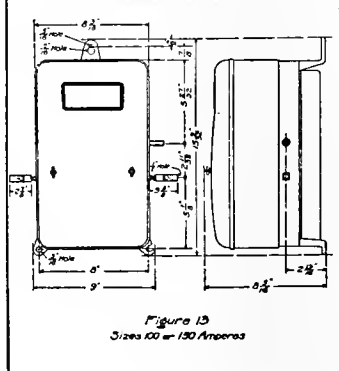


Figure 13
Sizes 100 or 150 Amperes

H 10.92

WATTHOUR METERS

Direct Current Watthour Meters
Size 300 Amperes, 500 Volts

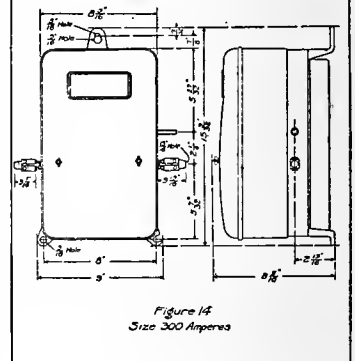


Figure 14
Size 300 Amperes

H 10.93

(To be continued.)

HOW TO REMEMBER THE WIRE TABLE.

The copper wire table, B. & S. gauge, has simple relations, such that by remembering a few constants the whole table can be constructed with approximate accuracy.

A wire which is three sizes larger than another wire has half the resistance, twice the weight and twice the area. A wire which is 10 sizes larger than another wire has one-tenth the resistance, 10 times the weight and 10 times the area.

No. 10 wire is 0.10 in. in diameter (more precisely 0.102); it has an area of 10,000 circular mills (more precisely 10,380); it has a resistance of 1 ohm per 1000 ft. at 20 deg. Centigrade (68 deg. Fahrenheit), and weighs 32 lb. (more precisely 31.4 lb.) per 1000 feet.

The weight of 1000 ft. of No. 5 wire is 100 lbs.

The relative value of resistance (for decreasing sizes) and of weight and area (for increasing sizes) for consecutive sizes are: .50, .63, .80, 1.00, 1.25, 1.60, 2.00.

LETTER TO THE EDITOR.

Los Angeles Aqueduct Mistakes.

Sir:—As you invite comment on Los Angeles aqueduct matters in your issue of October 24th, permit me to state as follows:

For a long time after the report made by the Peoples' Investigation Board, many people were in doubt regarding the facts. It has now become recognized, however, that the Board made an extremely conservative report, and there are few people of the class seeking to be informed in this city, who do not know that the Los Angeles aqueduct was a scheme to benefit real estate operators, in the San Fernando Valley, and not required for the city of Los Angeles.

There is no well informed hydraulic engineer in Los Angeles, who has resided here long enough to be familiar with conditions, and who is disinterested, to whom the fact is not known that the water resources available, before the aqueduct was constructed, can be made applicable for a city of 1,000,000 population. This fact is capable of absolute mathematical demonstration.

The future growth of the urban population in Los Angeles will nearly all be over irrigated areas, contiguous to the city. As these areas are cut up into lots, the water formerly used for irrigation becomes more than sufficient to supply the new domestic requirements.

Recently the people have also become convinced that the construction work on the aqueduct is much worse than was claimed by the People's Investigation Board. This has become apparent from the many disasters, which have befallen the work in spite of the fact that only a little water for short intervals, has been carried through the conduit.

A demand was made to have the work tested, by passing a full flow through the aqueduct for 60 days, and wasting the water into washes on the desert, which would readily absorb it, but those in charge of the water department have refused to make such a test. There is but one conclusion to be drawn, namely, that they are as well informed regarding the inferior work as those who criticise it. Their freedom from exposure depends on the length of time during which they are able to prevent the work from being thus tested.

During the present summer, a large volume of short duration was passed through 60 miles of channel above Haiwee Reservoir, for sluicing out debris washed into the aqueduct above this point. It did so much destruction to the concrete work, that it was discontinued, and extensive patching had to be undertaken to restore the concrete lining. The effect of this patching can be readily seen by observers, as the difference in color of the old and new work is easily distinguished.

In connection with this defective tufa cement the following quotations from the testimony of Mr. Edward Johnson, formerly a member of the Board of Public Works of this city, given before the Aqueduct Investigation Board, is illuminating:

"Question—Do you not regard tufa cement as strong or as hard as concrete made of straight Portland cement?"

"Answer—I do not consider it as good in any way, except that it is applicable to certain uses in which

it might be used without any great harm. If I were building the aqueduct today, I would not use it anywhere. I do not think it would be worth the money you would save on it using it anywhere."

"Question—Do you think the expense in repairs and maintenance are likely in a very short time to more than eat up the \$500,000 saved in the use of it?"

"Answer—I think they will, yes sir." (See page 73, report of Peoples' Aqueduct Investigation Board.)

There are two reasons why the aqueduct people do not admit the facts so generally known in this city, regarding the project and character of the work, as stated by Mr. Warner.

The first is, that the proprietors of the principal newspapers in this city are interested in the San Fernando Valley land speculations, and cannot afford to admit the facts, because it would hurt their private interests.

The second is that most of the people who know the facts, believe that an exposure of the truth to the outside world will injure the city of Los Angeles generally.

In regard to these I believe the first reason is well taken, as an exposure would injure the value and prevent sales of the San Fernando property. As to the second, however, I am strongly of the opinion, that to tell the outside world the truth, and set about to remedy conditions by making the San Fernando Valley speculators come through with money to make the aqueduct right, will eventually benefit the city more than to conceal the true facts.

The policy of secrecy now carried on is solely for the purpose of suppressing truth to aid in the sale of the San Fernando Valley property, which is not such a difficult matter to do with the support of the local press, and the active co-operation of the high salaried officials, in charge of the aqueduct, to cover up their mistakes and save their salaries. There are three men drawing jointly \$27,000 per annum in salaries, to say nothing about their expense accounts and the numerous others, who receive smaller salaries, although the aqueduct work was reported to have been completed, and a celebration held a year ago.

While drawing these salaries, these men are devoting their time to rendering services for compensation to others than the city of Los Angeles, except when they are called upon to suppress the true facts concerning the Los Angeles aqueduct.

It is incredible, however, that the people of this city can much longer be fooled in this fashion, and yet a complete exposure is not likely, until the city becomes totally bankrupt. The reason for this is the false civic pride of so many people. Yet questions are now beginning to be asked, such as why it is almost a year since the completion of the aqueduct was celebrated and still no revenue from the project is in sight, although the city is contributing over \$2,000,000 per annum in interest, sinking fund and maintenance.

In the meantime it is a pertinent question to ask, how the city of Los Angeles can develop any reliable power from an aqueduct, such as has been provided.

Personally I called attention to these pitfalls and the un wisdom of doing cheap and inferior construction work years ago, when there was still time to avoid these mistakes. For this I received nothing but

abuse from those who were profiting by the undertaking. This, however, makes no difference, as the truth is mighty and will eventually prevail.

Conditions are now so apparent that an expert observer can go over the aqueduct and see for himself, and any person of ordinary education can go over the accounts of the aqueduct and water department in this city and see that these departments are both bankrupt.

Respectfully,

F. C. FINKLE.

Los Angeles, Cal., Oct. 27, 1914.

FACTS FOR SETTLERS.

"Some Things the Prospective Settler Should Know."

This is the weapon the University of California has placed in the hands of the newcomer to the state and of the man who has heard the call, "Back to the land!"

Here is a free publication of the College of Agriculture telling what it costs to go to farming, how much investment a competent farmer must make to get a reasonable living, how much yield of each of the standard crops of California may on the average be expected, and how large an acreage is on the average needed to support a family from each of the various types of California agriculture. Dean Thomas F. Hunt and the best experts of the agricultural faculty have combined in this publication their experience, knowledge, and judgment.

A man who can grow only the "average crop" is here warned that, generally speaking, he will do better working for a daily wage for others.

On the other hand, the settler is advised not to figure on raising more than two-fifths of the maximum yield possible in the neighborhood in which he is to locate.

So, for example, the average yield of barley in California is here stated as 25 bushels to the acre. A hundred sacks is declared possible, but extraordinary. A competent man may hope to raise 50 bushels. But a safe basis for figuring, for business purposes, would be 40 bushels.

For potatoes, 125 bushels is stated as an average, 200 as a good yield, and 175 as a safe estimate; for Muscat raisins the figures given are half a ton, a ton, and three-quarters of a ton to the acre; for butterfat per cow per annum, 150 pounds, 300 pounds, and 225 pounds; for alfalfa, $3\frac{1}{2}$ tons, 6 tons, and 5 tons, and so on for all the great standard crops of California.

How large must a farm be to furnish a satisfactory living?

What a satisfactory living is one must decide for himself, but to earn a gross income of \$4000 a year the acreage needed, figuring on a safe basis as before, would vary according to the comparative table given, from a dozen acres for orange trees in full bearing to 33 for onions or potatoes, 60 acres for dairying, 91 for rice, 100 for alfalfa-raising, 167 for barley, or 235 for wheat. Of the gross income, a large share would rep-

resent interest on the investment, another large share would go for expenses, and a moderate share remain as remuneration to the farmer and his family for their work. And of course figures as to yield and acreage vary greatly for differences in land and differences in skill.

Children are a material asset to the farmer, here declares Dean Hunt. Their labor is an advantage not only to the family income, but "because this training in contributing to the family income which they receive before the age of 21 is one of the most valuable assets these children can acquire."

Here are some of the warnings to the settler now sounded by the College of Agriculture of the University of California:

Don't figure too high on prospective yield.

Don't figure too low as to the amount of land you'll need.

Don't expect to make a satisfactory living at dairying on twenty acres.

In selecting land be sure the soil is deep and well drained. Hardpan and alkali go along with lack of proper drainage.

Consult the University and United States soil surveys, when available.

Remember that the sale of land for purposes for which it is not adapted has caused great losses and great misery, so be sure the land is suited to the crop to be grown.

Watch out that the land title is secure.

And in buying land remember that no law can furnish men with judgment.

"Probably nothing can make a man keen in a horse trade save experience," says Dean Hunt.

A striking statement is that the average size of California farms is 317 acres, and their average value is \$16,447, yet three-fifths of the farm land in California is held in tracts of a thousand acres or over. These seventeen million acres, however, are only five per cent of the number of farms. One-fourth of all California farms are less than 20 acres in area, one-fourth between 20 and 49 acres, one-fourth between 50 and 174, and one-fourth of 175 acres or more.

After discussing climate, soils, irrigation, farm labor problems, "how to start," and the affairs of the man who rents land, this publication concludes with a special discussion of each of the standard crops of California, written by a special authority in that special field. These tell of where to see the particular industry to best advantage, objections to the crop, things to avoid, methods in use, methods of renting, marketing conditions, land and rental values, etc.

The crops thus specially discussed are alfalfa, almonds, barley, beans, citrus fruits, cotton, figs, grapes, olives, onions, pears, prunes, potatoes, semi-tropical fruits, sugar beets, and walnuts.

This publication, which promises to be of inestimable value to those who want to make their home in the open country in California, can be had for the asking by writing to the University of California at Berkeley.

THE PURPOSES OF NATIONAL FORESTS AND THEIR PROTECTION.

BY CHAS. H. FLORY.

(This paper was read before the Oregon Society of Engineers at a luncheon on October 12. The author is assistant district forester at Portland.—The Editor.)

A noted French writer once remarked that "In its forests lies the heart of a nation and a people without forests is very close to extinction."

Once, Tripoli was clothed with abundant vegetation which secured the stability of the soil, making it possible to establish cities surrounded by prosperous cultivation. It formed then one of the granaries of the Roman Empire; now we find but the desert and ruins. The whole of this plain has become sterile, owing to the disappearance of the forests of the interior. Today only a few places are found which will support a few fields of barley and other grain for the meagre maintenance of miserable and decimated tribes. It is said that the present condition of the whole of northern Africa is the result of the ceaseless devastation of its forests. Central Asia, once a garden of exceptional fertility, is now a desert. In King Solomon's time, the mountains of Palestine were clothed with "Cedar's of Lebanon" and the land, "flowed with milk and honey." Today only a few small groves mark the remnant of a once vast forest and the land will hardly support the remaining nomadic tribes.

The famine and pestilence which sap the life of China can be largely traced to the wasting of its forests. The president of Baptist College, Shanghai, states:

China's hills and mountains are deforested. This is particularly true in the hilly country drained by the Yangtse River. * * The river brings the soil down with it. That is the reason why we have the Yellow Sea. For 300 miles out from land the ocean is discolored by the silt brought down by the Yangtse.

These countries have paid the price of the early dissipation of their forests in the present wastes of sand and sterile lands. Perhaps changing climate has to some extent been the cause, but it is evident that the present situation is largely due to complete forest removal.

These are extreme examples to be sure and it is hardly possible that the United States ever will be reduced to a state of poverty through senseless wasting of its timber resources, but they point a moral, in that economy should ever be our watchword. Conservation does not mean preserve and not touch, but occupy and use; but use wisely.

Our national Congress very early saw the necessity for economy of its timber resources. One hundred and fifteen years ago, the first act was passed which provided for the purchasing of lands and the growing of timber suitable for use by the navy.

Since then, as the public gradually awakened to the realization that many of our natural resources were being ruthlessly destroyed, Congress has passed many acts, all tending to encourage economy and judicious use of the vast stores of natural wealth which a bountiful nature has bestowed upon us.

Finally, in 1891 an act was passed whereby vast areas of timbered lands in the mountain ranges of the West were withdrawn from private entry and set

aside for the use of the general public. The management of these lands, now known as National Forests, justifies the existence of the United States Forest Service.

No plan of forest management can be successfully carried out unless adequate preparation has been made for protection against fire; this is absolutely fundamental. In a few hours fire can destroy timber that has required hundreds of years to grow. It is obvious that the forester who must wait a hundred years or so for trees which he plants to reach maturity, would be exercising the rankest kind of folly in maintaining nurseries, conducting reforestation on large scale, and establishing long periods of scientific treatment to assure a future supply, if he made no effort to prevent his labors from going up in smoke. A burned city can be rebuilt in a few months but it takes a lifetime to grow a forest. If the forest crop is to be harvested it must be protected constantly during the time of its growth. It would seem from the importance which the lumber industry plays in the development and economic welfare of the entire country that the necessity of fire protection would receive as much conscientious thought on the part of the public, as the protection against fire in our cities. Millions of dollars are annually spent and carefully drawn laws are rigidly enforced for the protection of property in cities and towns, but there is a woeful lack of effort or even interest in many localities toward one of the most vital problems of our day—that of protecting and conserving the remaining timber so that a perpetual future supply can be assured.

In spite of the fact that the federal and state governments and private associations are spending hundreds of thousands of dollars each year for fire protection approximately seventy-five per cent of all fires are caused by man's carelessness, the remaining twenty-five per cent being caused by lightning over which we have no control.

Fortunately, however, due to the persistent campaign of education which the various fire protection agencies have been carrying on during the past two or three years, the public conscience is awakening from a state of apathy regarding forest fires. Only a short time ago we looked upon forest fires as unavoidable as storms, financial depression, and taxes. The annual visitation of fires in our timbered regions was accepted as inevitable. No one ever gave a thought to their suppression or prevention. We knew they were deplorable and caused suffering, loss of property and death. Yet in our minds we knew that the terrible fires which have ravaged our timber could have been prevented if they had been extinguished in their incipency. But as is so often the case, what is everybody's business is nobody's business.

We are beginning to realize now that we individually share in the loss of timber destruction, and that it is the business of each one of us to help. Of each thousand board feet of timber destroyed in the state of Oregon, if the owner loses say \$2.00, there is a direct loss to the public in wages, supplies, etc., of about \$8.00. The owner is always the smaller loser. When we fully realize this fact we can understand that forest fires are unnecessary, useless, and a menace to our industrial welfare.

At certain seasons fire is an ever-present danger on the National Forests. The great size of the Forests compared with the number of the patrolling force, the difficulty of reaching remote areas across miles of wilderness, the dry air and light rainfall in parts of the West, the prevalence of lightning in the mountains, and the constant use of fire in the daily life of the people and in the industries all combine to make the hazard exceptional.

Among the chief causes of fire are railroads, lightning, campers, slash-burning, incendiarism, and steam sawmills. The great fires of 1910, which swept Idaho, Montana, Oregon and Washington, destroyed many millions of dollars worth of timber and 85 human lives and cost the United States nearly a million dollars in fire-fighting. Like all other great conflagrations, these began, with small fires which were fanned into fury by gales of wind. A small fire may at any time spread into a conflagration, and fires, matches, and burning tobacco should be used as carefully in the forest as they are in the home. Carelessness in this respect may mean the loss of lives, homes, stock, and forage, and of a vast amount of timber which belongs equally to all citizens.

Fires may start in a region remote from supplies and water and reach vast proportions before a party of fire fighters can get to the scene, no matter how promptly the start is made. By far the best plan, therefore, is to prevent fires rather than to depend upon fighting them once they start. This subject has been given the most earnest attention by the Forest Service. During the danger season the main attention of supervisors and rangers is devoted to preventing fire. Many men are employed, the forests are systematically patrolled, and a careful lookout maintained from high points. Roads and trails are so built that every part of the Forest may be quickly reached with pack animals. The ranger stations and lookout points are connected with the offices of the supervisors by telephone, so that men may be quickly assembled to fight a dangerous fire which the patrolman can not subdue alone.

During the past few years the Forest Service has constructed over 2200 miles of trails and nearly 2500 miles of telephone lines in the state of Oregon for the purpose of affording rapid communication in times of danger. Over seventy-five high mountain peaks and exposed ridges have been chosen at strategic points, on the tops of which a lookout man remains night and day throughout the fire season. He is furnished with a house and supplies are brought to him by a patrolman. He is equipped with a telephone, or heliograph, and a fire-locating device by which he can accurately locate any visible fire. He is required to report to his supervisor at regular intervals throughout the day as to general conditions as he sees them, and reports at once any fire discerned. The lookout system has proven to be the most efficient of all means of fire discovery and location, and is being very rapidly extended over the entire mountainous regions of the West.

There is an old Arabic adage that if the house is on fire, and there are but three minutes in which to save the contents, two should be employed in planning what to do. This is alright in a way and would

no doubt often save a costly mirror being thrown out a window while the feather bed was being carried down stairs; but when a forest is on fire the situation is different. Owing to the fact that fire often starts miles away from immediate means of communication in a wilderness difficult of access, it is absolutely necessary that we plan far in advance just what to do in case a fire starts. Each year, before the fire season begins, arrangements are made with loggers, millmen, employment agencies, etc., for the immediate supplying of certain numbers of men upon an instant's notice. Reliable ranchers, settlers, or other residents in the neighborhood of the forests are engaged to act as foremen of fire-fighting crews when called upon. Stores, logging commissaries, hotels, etc., are selected to furnish equipment, supplies or meals. Arrangements are made with livery stables, garages, and settlers to furnish a given amount of transportation. The telephone number of every settler in the county is known and listed. At convenient places all over the forests tool boxes are constructed which contain a supply of axes, shovels, crosscut saws, water bags, provisions, grain, etc., for use in fire fighting. All such boxes are shown on a map of the district over which a ranger has charge. All these various things are known to the ranger and he systemizes them into a fire plan so that when a fire is reported to him from one of his lookout men he knows exactly what to do. In other words eternal preparedness is the rangers' slogan.

The past season proved the soundness of this fact beyond all question. Not in years have we had such a prolonged dry hot summer. In many years the fire season was more serious than the memorable one of 1910. Probably a thousand fires started in the state of Oregon this summer, but practically no green timber was killed or destroyed. Therein lies the acid test of a fire-fighting organization. It is the prevention of timber destruction and not what it costs to fight fires that determines our efficiency. It cost us \$124,000 to extinguish the fires in the National Forests in Oregon and Washington during the past summer, but we saved from destruction millions of dollars' worth of the finest timber that grows. But in this connection, I want to give credit to the many hardy pioneers who, living far back in the sparsely settled mountainous regions, gave us their hearty support and co-operation during one of the most critical periods of our history by helping defend the nation's property from the enemy fire.

The Forest Service is often accused of being out of sympathy with the settler and that we do not welcome him among our midst. This is not so.

The National Forests are being classified as rapidly as possible to segregate the lands chiefly valuable for agriculture, and make them available for homeseekers. Whenever considerable bodies of such land are found, they are either eliminated from the forest or are listed with the Secretary of the Interior, to be opened to entry under the forest homestead act. The bulk of the agricultural land in the National Forests occurs as scattered individual tracts along streams, the bottom of ravines and swales, and on narrow benches and on the base of slopes. Although I must add that most of the valuable agricultural land has

already been settled upon. These scattered tracts, which may be used to build up a home, are sought out and settlement encouraged. Home-seekers may apply for tracts which may seem to them to offer the opportunity for a farm. These areas applied for are given the preference in the classification work, and are examined as expeditiously as possible. If found chiefly valuable for agriculture and not needed for public purposes, they are listed with the Secretary of the Interior to be opened to entry.

The use and occupancy of the agricultural lands in the Forests is desired from every standpoint. Every added home helps in the upbuilding of the country. The forests are to serve the people in the permanent development of homes and industries. In addition, the settler is a great help—practically a necessity—in the protection and development of the forest itself. Every strip of cleared land is a fire-break; every ranch is a vantage point to prevent and fight fires; every settler may become a forest protector.

If time were available I should like to tell you more about the daily activities of the Forest Service, how we sell and market the timber that is ripe for cutting, how we guard the streams and keep them running pure from the public fountains on our street corners, how we utilize the grass and weeds in our forests in the support of hundreds of thousands of sheep, cattle and horses, how we gather seed and grow acres of little trees to later reforest old burns, how we make laboratory tests of the strength of various kinds of timber and search for new species of trees as substitutes for those fast disappearing, what we are doing for the good roads movement and how we are helping to maintain the country schools; and finally, how we are making available for recreation and pleasure a vast new and unknown country almost at our doors. Nowhere in the world can there be found such wonderful mountain scenery and such fine camping and hunting places as within the National Forests. All within a few hours' ride of Portland. In other words, the National Forests are the national playgrounds. They await your coming either for business or pleasure.

RULES FOR RESUSCITATION.

In line with its campaign to reduce the number of deaths in the mines of the United States, the Federal Bureau of Mines some time ago appointed a committee of eminent physicians and surgeons to develop an efficient method of resuscitation to be administered by miners or other persons to a fellow-workman overcome by electric shock or by gases in places which cannot be reached by a physician or surgeon in time to save life.

As a result of this committee's report just made, the Bureau of Mines, through Director Joseph A. Holmes, recommends the following procedure in rendering first aid to those in need of artificial respiration.

The recommendations apply not only to men who are overcome by electric shock or gases in mines, but also to persons suffering from the effects of illuminating-gas poisoning or from electric shock anywhere. The recommendations are, therefore, of importance to many thousands of workmen:

In case of gas poisoning, remove victim at once from the gaseous atmosphere. Carry him quickly to fresh air and immediately give manual artificial respiration. Do not stop to loosen clothing. Every moment of delay is serious.

In case of electric shock, break electric current instantly. Free the patient from the current with a single quick motion, using any dry non-conductor, such as clothing, rope, or board, to move patient or wire. Beware of using any metal or moist material. Meantime have every effort made to shut off current.

Attend instantly to the victim's breathing. If the victim is not breathing, he should be given manual artificial respiration at once.

If the patient is breathing slowly and regularly, do not give artificial respiration, but let nature restore breathing unaided.

In gas cases, give oxygen. If the patient has been a victim of gas, give him pure oxygen, with manual artificial respiration.

The oxygen may be given through a breathing bag from a cylinder having a reducing valve, with connecting tubes and face mask, and with an inspiratory and an expiratory valve, of which the latter communicates directly with the atmosphere.

No mechanical artificial resuscitating device should be used unless one operated by hand that has no suction effect on the lungs.

Use the Schaefer or prone pressure method of artificial respiration. Begin at once. A moment's delay is serious.

Continue the artificial respiration. If necessary, continue two hours or longer without interruption until natural breathing is restored. If natural breathing stops after being restored, use artificial respiration again.

Do not give the patient any liquid, until he is fully conscious.

Give him fresh air, but keep his body warm.

Send for the nearest doctor as soon as accident is discovered.

The members of the committee reporting to the Bureau of Mines are as follows: Dr. W. B. Cannon, chairman, professor of physiology, Harvard University; Dr. George W. Crile, professor of surgery, Western Reserve University, Cleveland, Ohio; Dr. Joseph Erlanger, professor of physiology, Washington University, St. Louis; Dr. Yandell Henderson, professor of physiology, Yale University; and Dr. S. J. Meltzer, head of the department of physiology and pharmacology, Rockefeller Institute for Medical Research.

The penetrating power of an X-ray tube depends largely upon its vacuity. A high vacuum, or "hard," tube emits a few rays of great penetrability, a low vacuum, or "soft," tube gives more rays of less penetrability. A pinkish light indicates too low a vacuum, a greenish-yellow light normal conditions, and the absence of glow indicates too high a vacuum. From 50,000 to 100,000 volts is necessary for the operation of the tube. The transparency of a substance to X-rays is approximately inversely proportional to its specific gravity, the transparency of water being unity. Thus platinum is 100 times more transparent than pine wood.

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It is high time to stop fault-finding about business conditions and begin cost-finding. This applies to every branch of the electrical industry, but particularly to the contractor, if any profit is to be gained from the lessons of the past and opportunities which the future now offers.

Cost Finding

In the keen competition of modern business a minimum of cost is essential to a maximum of profit. Costs must be known before they can be minimized. Yet how few really know how to find their costs.

Not realizing that each business requires individual study, many a firm has installed a so-called cost system and tried to fit their business to the system instead of adapting a system to their business. After a period dependent upon the patience of the management the system is usually discarded and the costs are again approximated.

Costs are based upon facts, not theories. Guesswork never finds costs nor do round numbers roll into round dollars. To guess is to gamble.

Ignorance of costs not only ruins the ignorant individual but also hurts the entire industry. The man who bids too low because he does not know his costs not only loses money himself but also prevents others from making money. Furthermore there is always a new fool to rush in where he has some angel to back him. Consequently those who have learned how to find their own costs would do well to give the fullest publicity to what they have learned in order to prevent others from ruinous under-bidding.

There are a few general principles that govern all methods of cost finding. These include the segregation of all expense items into material, labor and overhead, and their allocation into a scheme of statistical records showing the results of past operations. From this it is possible to find the cost of each individual article or act, to find what lines of endeavor are paying and to predict future operations.

But it is necessary that each business be studied independently and a method be adopted to meet its peculiar needs. Some businesses require a more detailed analysis than others. There is as much danger from too many cost data as from too few. Information which is not used represents wasted money. There must be judgment in the installation and use of any system.

A cost system, while it has little or no relation to the general financial accounting of a business, can be used to advantage in furnishing much of the information from which the general financial statement is condensed. This interlocking of accounts should be of especial value to central stations, where the manager must know when and why the losses as well as the profits occur. A modern business without a cost-finding system is like a ship without a rudder and in these days of strenuous competition is in danger of going on the rocks of failure.

No saying of recent times has been subjected to more ridicule than President Wilson's statement that our financial troubles are psychological. While ridicule is one of the strongest weapons of offense, it is not necessarily in the right.

Faith in Action

Careful analysis demonstrates that there is more truth than fiction in his much-quoted opinion as to the cause of the hard times.

In the first place "psychological" does not mean imaginary, as the jokesmith would have you believe. Because a value is intangible does not make it less real. Everyone concedes that business is now in a negative cycle, which has succeeded and precedes a positive cycle. The business depression is an admitted reality. But present fact is the effect of some preceding cause.

That cause was primarily lack of confidence. It began with a lack of confidence in the political party in power. Without arguing whether this was justified by act or threat the fact remains that financial men in the East had little faith that their interests would receive fair treatment. This lack of confidence has been augmented by the fear engendered by the European war.

Yet both doubt and fear are only temporary. A reaction of confidence and courage is inevitable and those who are best prepared will profit most. Already the exports of bread-stuffs have exceeded all previous records, crops have been good and a ready market is assured for all our products.

Particularly is this true in the West, where the natural resources are just beginning to be developed. As a consequence, the people of the West are undaunted in their faith of an early and favorable outcome.

It is easy enough to have faith after a thing has been demonstrated. The credit belongs to those who have the courage of their convictions and whose faith is reinforced by action based upon the assurance that history repeats itself and the belief that we are now on the verge of an unprecedented era of prosperity.

Doubt listens to the discouraging reports which faith does not believe; doubt looks discouraged, while faith is cheerful in the face of disaster; doubt is fearful, faith is courageous. Passive submission will never bring success. Determination, purposeful will, converts faith into action.

Faith in action is enthusiasm. Let us therefore be enthusiastic. The poor timber has been eliminated from every organization, finances have been dehydrated and every business is stripped and ready for effective action. Enthusiasm is contagious. Like magnetism it can be induced in others, strengthening rather than weakening our own. If we enthuse over prosperity we will soon be prosperous, if we think and act poverty, we will never be prosperous.

Enthusiasm is one of the greatest assets which a man can possess. It convinces and dominates cap-

ital, it overcomes prejudice and opposition, spurs in action and in the end it gets results.

Mistakes are made by everybody. They should be regarded not as a matter of shame, but as a subject for correction. They should be carefully analyzed as to cause in order that they may be avoided in the future. A man that never

The Value of a Mistake

made mistakes never made anything else—the main thing is not to make the same mistake twice.

Every man should also regard it as a duty and a privilege to tell others of the how and why of his mistakes so that they may likewise avoid them. Such is the advice that a father gives to his son. The unnecessary duplication of mistakes is an economic crime which can be obviated only by full publicity.

Concealment of a mistake is a selfish impulse. It is a false pride that allows a man to tell only of his successes and to gloss over his failures. Most successes have been built upon the lessons learned from previous failures. A broad man not only learns from his mistakes and from the mistakes of others but is also willing that others may have the benefit of his experience.

These thoughts have been brought to mind by the query as to what is to be gained by calling attention to the alleged mistakes in the construction of the Los Angeles aqueduct.

It is argued that the city eventually will benefit from this water supply and that no useful purpose can be served by giving publicity to the mistakes associated with it. It is also stated that much of the dissatisfaction has been instigated by the cement interests because their product was not used in its construction. Yet there has, as yet, been no authenticated proof that the findings of the investigating board were not true. If they should be forthcoming they will be accorded the same publicity which is now being given to the accusations of poor engineering practice. The columns of this journal have always been open to both sides of any discussion in order that the readers may draw their own conclusions.

It is the function of a technical paper to mirror rather than to mold public opinion, always with the ultimate purpose in mind of educating the reader. Young men, particularly, need as much instruction on how not to do things as on how to do them. Many an executive holds his position, not because of what he does, but because of what he does not do.

The experience of Los Angeles should be a warning to other municipalities in the acquisition of a water supply. From time to time it is hoped to publish in these columns other examples of how not to do things, all with the broad, generous purpose of helpfulness in mind. It is not the purpose to select any particular piece of work as a shining example, but rather to investigate the weak points of all work. Contributions in this vein of constructive criticism are invited.

PERSONALS

A. H. Babcock, consulting electrical engineer Southern Pacific Company, is in Arizona.

H. M. Byllesby, president, and **O. E. Osthoff**, vice-president of H. M. Byllesby Company of Chicago, Ill., are at San Francisco.

P. D. Callahan, Faries Manufacturing Company, of Decatur, Ill., is a recent business visitor at San Francisco.

W. P. Naser, representative Trumbull Electrical Manufacturing Company, is a recent business visitor at San Francisco.

C. E. McNeil has resigned as local manager of the White Salmon, Wash., plant of the Pacific Power & Light Company.

E. C. McBrearty, representative of the American Electrical Heater Company, is at San Francisco from Detroit, Mich.

Gerald Porter has been appointed assistant chief engineer of the B. C. Electric Railway Company at Vancouver, B. C.

J. W. Little, superintendent of the Ramsay Street Railway System of Ramsay, Ill., is a recent business visitor at San Francisco.

C. W. Yerger of the Los Angeles office of H. B. Squires Company of San Francisco has left for the East on a short business trip.

F. E. Newberry of the F. E. Newberry Company has returned to Los Angeles from an extended trip throughout the Pacific Coast.

M. J. Hixon, salesman of General Electric Company, San Francisco, returned the first part of the week from a business trip to Nevada.

C. H. Carter, manager of the Pacific States Electric Company was at San Francisco during the past week to attend the wedding of his sister, Miss Madeline Carter.

C. E. Johnson of the American Ever Ready Works of the General Electric Company, is visiting the trade in the Pacific Northwest. His headquarters are at San Francisco.

G. H. Heyer, railway sales engineer for the Western Electric Company, is visiting the Pacific Coast from New York. He left San Francisco this week to go to Los Angeles.

H. F. Yost, representative Electric Railway and manufacturers' Supply Company of San Francisco, has recently returned from an extended business trip throughout Nevada.

E. C. Leighton, Seattle, has been awarded the contract for the wiring and lighting of the Hanford Street Warehouse by the Seattle Port Commission. The contract price was \$4035.

W. Brewster Hall, representative of Pass & Seymour Company, San Francisco, arrived in that city the first of the week, leaving immediately for a business trip to Salt Lake City.

H. E. Sanderson, Pacific Coast manager Bryant Electric Company at San Francisco is making a business trip throughout the Northwest. He expects to return about the last of this month.

H. W. Kent, one of the most popular electrical men in Western Canada, has been appointed manager of the Vancouver branch of the Northern Electric Company, vice Mr. Roeder, resigned.

J. B. Challis, engineer with the conservation branch of the Canadian Department of the Interior, has returned to Ottawa after investigating water power records and statistics in British Columbia.

D. A. Reed, counsel for the United Railways Investment Company of Pittsburg, Pa., the holding corporation for the United Railroads of San Francisco, is a recent business visitor at San Francisco.

J. E. Adams was elected president of the Stockton Terminal & Eastern Railway at a recent meeting; also **C. M. Prater** was elected auditor and traffic manager; directors,

H. J. Kennedy, **D. F. Owens**, **Francis George**, **Mary Turner**, **M. L. Scott** and **Theo. C. Bee**.

T. J. Pace, manager of the arc lamp division, and **J. G. Miles**, manager of the supply division, Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., were arrivals at San Francisco during the week.

F. H. Leggett, Pacific Coast manager for the Western Electric Company, has returned to San Francisco from Atlantic City, where he attended a meeting of the district managers of the Western Electric Company.

Theodore Powers, former manager of the Pacific Power and Light Company, at Waitsburg, Wash., has accepted a position with the Portland, Eugene & Eastern Railway Company at Portland, effective January, 1915.

George R. Cooley, an electrical engineer of Seattle, who is also a councilman, has introduced a bill in the city council which will require the filing of a bond for \$1000 for each installation or extension of electrical wiring work. The intent of the bill is to limit electrical work to those electrical contractors who are in a position to furnish a bond of \$1000.

W. L. Goodwin, vice-president of the Pacific States Electric Company; **R. M. Alvord**, manager detail and supply department General Electric Company, and **S. B. Gregory**, Pacific Coast manager Arrow Electric Company, are among those who plan to be at Los Angeles during the meeting of the executive committee of the California Electrical Contractors' Association, November 13 and 14.

Frank W. Hall has been appointed sales manager of the Sprague Electric Works, New York. Mr. Hall has been associated with the Sprague organization for the past nineteen years, occupying various positions of responsibility in the engineering and commercial departments. More recently he was manager of the Philadelphia office and subsequently manager of apparatus sales at the general office of the Sprague Works.

OBITUARY.

Louis Metzger Clement, a well-known civil and mechanical engineer in the West, passed away October 29th at his home in Castro valley, near Hayward, California. He was 72 years old and besides his widow, Charlotte E. Clement, he is survived by a son, Russell M. Clement, former city engineer of Oakland, and three daughters, Mrs. J. S. Maynard of Hayward and the Misses Maude and Gladys Clement. For a quarter of a century and more the name of Louis M. Clement was linked with all the big railroad building achievements west of the Rocky Mountains. He was engineer in charge of construction of the Central Pacific Railroad through the Sierras from 1861 until its completion in 1869. While with the Central Pacific he established the first patrol in the mountain snow sheds and built the first electric tunnel signals, as well as inventing the first emigrant sleeping car ever used by a steam railway. Later he designed and constructed the Hayes street cable road in San Francisco and built the Telegraph avenue street car line, one of Oakland's first electric railways. Afterward he was consulting engineer for Stanford University and the Southern Pacific.

Clement was a native of Canada, being born at Niagara. He was prominent as an engineer there before he started on his journey of 149 days to California with a pack train. He built the Montreal waterworks and several Canadian railways.

MEETING NOTICES.

Engineers' Club of San Francisco.

The annual dinner of the Engineers' Club was held in the club quarters in the Hotel Sutter on October 30th, with an attendance of over 80 members. The various reports showed the club to be in a prosperous condition with nearly \$5000 in the bank and 300 members. An extended discussion was held and a committee appointed to investigate renting permanent quarters in the Hotel St. Francis. The regular ticket of the nominating committee was unanimously en-

dorsed, the following being elected officers for the ensuing year:

President, W. W. Briggs	Treasurer, A. H. Griswold
1st Vice Pres., Thos. Morrin	Secretary, G. R. Murphy
2d Vice Pres., E. B. Bumstead	Directors, Frank H. Varney
	W. H. Shockley

W. W. Briggs, as chairman of the entertainment committee had provided a number of vocal artists, who added much to the enjoyment of the evening.

Alameda County Electrical Development League.

The Alameda County Electrical Development League, composed of representatives from power companies, electrical jobbers, manufacturers, dealers, contractors and telephone companies, etc., held its regular monthly meeting at the Key Route Inn, Oakland, Cal., on Saturday afternoon, October 31st, at 1:15 o'clock. The league took up several important matters for the improvement of electrical work in general, and were favored by a lecture by Mr. F. F. Barbour of the Pacific Gas & Electric Company of San Francisco, covering the electrical work of installation and illumination of the Panama-Pacific International Exposition at San Francisco. The league unanimously endorsed the adoption of the Alameda County bonds for participation in the Panama-Pacific International Exposition at San Francisco in 1915. The league is doing good work in the community and has very well-attended and enthusiastic meetings.

Contractors' Dance.

The San Francisco Section of the California Association of Electrical Contractors and Dealers celebrated the association's fifth anniversary by a dinner dance at the Pompeian Court on August 20th. C. F. Butte, president of the Section, presided at the dinner, calling for brief remarks from C. V. Schneider, W. S. Hanbridge, L. R. Boynton, Frank Somers, W. D. Kohlwey, W. L. Goodwin, W. S. Berry, Jas. M. Barry, S. B. Gregory and M. L. Scobey.

The hall was beautifully decorated, an electric fountain spraying in the center. Tables were arranged at one end and the balance of the hall was arranged for dancing, which was enjoyed until midnight. A feature of the evening was the response of Mrs. W. S. Berry to the toast to the ladies.

The following were present:

C. V. Schneider and the Misses Schneider, Electric Supply Co., Stockton.
Mr. and Mrs. W. S. Hanbridge and Mrs. V. Wilkinson, Contractors' Association.
Mr. and Mrs. C. F. Butte, Butte Eng. & Elect. Co.
Mr. and Mrs. W. D. Kohlwey, Kohlwey Light Co.
Mr. and Mrs. L. R. Boynton, Central Electric Co.
Mr. and Mrs. J. M. Carlson, Central Electric Co.
Mr. and Mrs. Chamblin and Mr. J. D. McDonald, Cal. Elect. Construction Co.
Mr. and Mrs. N. Hope, Turner Co.
Mr. and Mrs. W. Kisten, Kisten Electric Co.
Mr. and Mrs. W. S. Berry, Western Electric Co.
Mr. and Mrs. Jas. M. Barry, Dept. of Electricity.
W. L. Goodwin, Mr. and Mrs. David Harris, Mr. and Mrs. M. L. Scobey, Miss Pantor, Pacific States Electric Co.
Mr. and Mrs. C. C. Hillis, Mr. and Mrs. Meinema, Electric Appliance Co.
Mr. and Mrs. Bert Hansen, A. G. Electric Co.
Mr. and Mrs. A. G. Drendell, Drendell Elec. & Mfg. Co.
Mr. and Mrs. S. B. Gregory, Arrow Electric Co.
Mr. and Mrs. A. G. Young, A. E. Rowe, Telephone & Electric Equipment Co.
Mr. and Mrs. H. Engel, Dunham, Carrigan & Hayden.
Mr. and Mrs. Jos. Thieben, Panama Lamp Co.
J. D. Flynn, Contractor, Insurance Dept.
Frank Somers, Century Electric Co.
Geo. Sittman, General El. Construction Co.
P. B. Hyde, Thos. A. Edison, Inc.
Messrs. Ross and Talent, General Electric Co.

Oregon Society Engineers.

The regular weekly luncheon of the Oregon Society of Engineers was held October 26th in the Crystal Dining Room of the Benson Hotel. The chairman of the day was F. D. Weber, electrical inspector of the Underwriters' Equitable Rating Bureau. The speaker of the day was Norman F. Titus, special agent Portland Steamship Company and the Dodge Steamship Company, also manager of the Commercial Dock & Warehouse Company. His subject was "The Portland-Alaska Steamship Line." Mr. Titus pointed out the

volume of trade that could be procured in Alaska and stated that a large percentage could be obtained by establishing salesmen routes in Alaska. Up to the present time Seattle has had all the trade of Alaska due to the fact that she had no competition. The opening of the Panama Canal would also make it possible to ship the immense tonnage of fish produced in Alaska to European markets. This being a valuable return cargo from Alaska for the new line of boats. Also the marble, coal, gold and copper of Alaska must be shipped and Portland should get her share handling the same. He also pointed out that the passenger business was of large proportions and that since the first ship of the new line had been established they had turned hundreds away, not being able to accommodate them.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision authorizing the Los Angeles & San Diego Beach Company, operating between San Diego and La Jolla to issue a sufficient amount of bonds to yield \$250,000 in cash. The proceeds derived from the sale of the bonds are to be used by the company for the electrization of its line, the improvement of its properties and the payment of certain obligations due E. S. Bahcock.

The commission has authorized the Holton Power Company to issue \$200,000 face value of its 6 per cent first and refunding mortgage gold bonds at not less than 80 and accrued interest. The proceeds from the sale of these bonds are to be used by the power company for various additions and betterments to its plant.

The Southern Sierras Power Company, operating in Inyo, Kern, San Bernardino and Riverside counties, has filed an application with the commission requesting authority to renew four promissory notes totaling \$20,000 for a period of 4 months.

The commission has issued a supplemental order authorizing the Fresno Interurban Railway Company to issue \$86,000 of its 1 year 6 per cent bonds at not less than 90, and 460 shares of its capital stock, having a par value of \$100 per share, at not less than 80. The proceeds derived from the sale of these securities are to be used for the construction of an electric railway between Fresno and Clovis, a distance of approximately 9 miles.

The commission has rendered an opinion supplementing its recent decision in which the Western States Gas & Electric Company was authorized to issue \$731,000 of 3 year 6 per cent promissory notes. The commission amends its previous decision to include the statement that in the opinion of the commission the purposes for which the notes are to be issued are not reasonably chargeable to operating expenses or to income.

The commission has issued an order extending to June 20, 1915, the effective date of its decision rendered April 2, 1913, in which the Pacific Electric Railway Company was authorized to issue \$6,839,000 of refunding mortgage 50 year gold bonds.

The Southern Sierras Power Company, operating in the counties of Inyo, Kern, San Bernardino and Riverside, has filed an application with the commission requesting authority to issue \$300,000 par value of its first mortgage 6 per cent 25 year gold bonds. The company proposes to sell these bonds at not less than 90 and to use the proceeds for the retirement of outstanding notes, discharge of various unpaid vouchers and partial payment of certain amounts due to the Sierras Construction Company for extensions and betterments to the power company's system.

NEWS OF WASHINGTON PUBLIC SERVICE COMMISSION.

The commission recently handed down an important decision in the case of the City of Seattle against the Seattle, Renton & Southern Railroad receivers. "A rule laid down by

the supreme court of the United States is the law of the land, and we therefore hold that the commission in appraising the right of way and terminals has the right to consider only the fair average market value of similar land in the vicinity. We therefore hold that the company has no right to include 'engineering,' 'legal expense,' 'interest during construction,' 'discount and commissions,' etc., based upon this hold-up value of the right of way of lands. If such methods of calculation are to be permitted in rate-making, the government cannot acquire these public utilities too soon. Under such a system this commission can never lower a rate once established.

"If an arbitrary multiple of 2 is permitted, by the same reason a multiple of 3 might be adopted. There is no logical reason, nor does justice demand that the patrons of a public utility pay interest on conjectural expenditures that were probably never made."

The Public Service Commission of Washington announces that valuation complaints will be filed in the immediate future against the Seattle, Renton & Southern Railway of Seattle for the purpose of establishing the actual value of that line, for rate-making purposes.

TRADE NOTES.

Herbert C. Moss, illuminating engineer, Seattle, has been awarded the contract for the electrical equipment in the new Elks' Club building, Tacoma.

Hunt, Mirk & Co., representing the Westinghouse, Machine Company, have moved their Seattle office from 909 Alaska building to 1407 Alaska building.

NePage-McKenna Company have received the electrical contract for the new Ballard High School to be erected in Seattle, Wash. The contract price was \$8845.

David Dow & Son, Seattle, are furnishing a double drum electric hoist to Gilbertson & Tanberg, who have the contract for the brick and stone work on the new Stuart building.

The United States Steel Corporation has been awarded the contract for steel rails for use in the Tacoma tide flats municipal line. The contract calls for 152 gross tons of rails.

The Portland Oxygen & Hydrogen Company is erecting a plant to supply oxygen and hydrogen for welding and other industrial purposes at East Seventeenth and Center streets, Portland, Ore. E. A. Finkbeiner is manager of the company.

BOOKS RECEIVED.

"Coal Gas Residuals," by F. H. Wagner; 179 pp.; 6x9. Published by McGraw-Hill Book Company, New York, and for sale by Technical Book Shop, Crossley Building, San Francisco. Price \$2.00.

This work constitutes at once a valuable contribution to the literature on the conservation of natural resources and a practical suggestion to the gas man. It is concerned with the recovery of tar, naphthaline, cyanogen ammonia and other products manufactured from the residuals of coal gas manufacture. Particular attention has been given to the details of the Feld process. This book should prove invaluable to gas chemists and engineers.

"Principles and Practice of Electrical Engineering," by Alexander Gray, assistant professor of electrical engineering at McGill University; 391 pp.; 6x9. Published by McGraw Publishing Company, New York City, and for sale by Technical Book Shop, Crossley Building, San Francisco. Price \$3.00.

This text is suited for individual study by those desiring to get a general idea of the principle of electrical engineering, being based on a lecture and laboratory course for students in civil, mechanical and mining engineering courses. The arrangements of the forty-three chapters follows a logical development from the simpler direct current to the more complex alternating current phenomena. The author has a clear, concise style and his explanations are more easily com-

prehended than in the average college text-book. A minimum of mathematical demonstration has been introduced and theoretical discussions are interspersed with descriptions of the instruments which are dependent upon each theory for their operation. The chapter on starting and controlling devices and on transformer connections are particularly good.

P. P. I. E. GAS EXHIBIT.

The following telegrams regarding a proposed exhibit of gas appliances at the Panama-Pacific International Exposition in conjunction with the meeting of the International Gas Congress during the week of September 27, 1915, are self-explanatory:

New York, October 23, 1914.

John A. Britton:

Committee on Gas Industry Exhibits P. P. I. E. active and many exhibits promised. Cowdery, chairman, wishes information. Can gas industry have collective exhibit? To whom ship goods, and how—who correspond with regarding shipments and care of them? What does P. P. I. E. do for exhibitions—what space is available—can we get twenty-five feet by three hundred feet? What will P. C. G. A. do in way of receiving and looking after exhibits before Exposition opens? Please wire me Hotel Astor.

E. C. JONES.

E. C. Jones:

P. P. I. E. can arrange to give space in manufacturers building eighty-five hundred square feet, being all of block one and part of blocks seventeen and eighteen. Plans can be seen at Acolian Building, Forty-second street, New York. Space contemplates doing away with Avenue A between Court of Honor Boulevard and Fifth street and moving aisle towards Avenue B so that space will be seventy feet on Fifth street and one hundred twenty feet on new avenue. No charge by Exposition Company for floor space. It requires, however, that organization exhibiting shall accumulate a fund equivalent to three dollars per square foot to be expended by organization in decoration features booth space, and pay for janitor service, etc. Plans of decorative features for space should be drawn up by architects and submitted for approval to Exhibit Committee Exposition Company in order that it may conform to requirements as to Underwriters' Rules, etc. If goods are shipped to Exposition Company prepaid, same will be returned to exhibitors without freight charge. Exposition Company requires that some one individual shall be in charge of all exhibits in order that direct responsibility may center and avoid confusion of a number of heads who might have to be conferred with by Exposition authorities. Above rate of three dollars per square foot is not to be handled in any way by Exposition Company, but as a guarantee fund that exhibit will be in keeping with other exhibits in the same building. This offer is made for prompt acceptance. Please wire.

JOHN A. BRITTON.

John A. Britton:

Wire received. Cannot give definite answer until next Saturday when Cowdery reaches Chicago. Committee says can raise quarter million dollars among manufacturers for exhibit. The ice has been broken and all gas appliance men express intention to exhibit. Have sent your wire to committee Chicago. I leave for home Wednesday. Please arouse interest in exhibit on Coast.

E. C. JONES.

After Mr. Jones returns from the East a meeting will be held for the purpose of providing ways and means for aiding this movement.

NEW CATALOGUES.

Snow plow service, as is well known, is one of the hardest applications that has to be met by street railway equipments, and the Boston Elevated Company is taking particular pains to see that these cars and their equipment are such as will fully meet the service which they are designed to perform. The Boston Elevated Railway Company has placed an order with the Westinghouse, Electric & Manufacturing Company for two quadruple equipments of No. 306 motors, and type HL unit switch control for use on two new snow plows which are being built by this company, and will be ready for the winter season.



NEWS NOTES



INCORPORATIONS.

ABERDEEN, WASH.—The Montesano Gas Company has been incorporated with a capitalization of \$50,000, by F. R. Archer, E. E. Boner and Sidney Burnett.

WINNEMUCCA, NEV.—Articles of incorporation of the People's Gas Company have been filed with a capital stock of \$100,000. The incorporators are J. R. McDonald, W. J. Compton, Frank L. Reber and W. J. Bell. The company is formed to install and operate a gas plant in Winnemucca.

FINANCIAL.

FWLER, CAL.—A deed of trust has been filed with the county recorder for the transfer of the gas plant from the Fowler Gas Company to Adam D. Wilson. Mr. Wilson is one of the trustees, and the filing of the deed is the completion of the deal entered into some time ago between the city and A. A. Weber of Los Angeles, who promoted the gas plant in this city and carried it to a successful conclusion. The city will hereafter conduct the gas works and furnish gas to the city. The consideration is said to have been \$15,000. The city takes over all holdings in all departments.

OAKLAND, CAL.—It is reported that a reorganization plan for the People's Water Company will be presented within a few days. It is said that the plan is being formulated by C. O. G. Miller, chairman of the committee, representing the holders of the People's Water bonds, who will submit it to the protective committees for the other classes of bonds. Of the several plans that have been under discussion and gossiped around the financial district is the following: The issuance of first mortgage sufficient to take up at par all the so-called underlying bonds and the notes of the People's Water Company secured by the People's Water bonds; the issuance of common stock sufficient to provide at par for People's Water bonds outstanding and sufficient to provide at 20 for the preferred stock the common stock to receive nothing.

ILLUMINATION.

AZUSA, CAL.—Bonds in the sum of \$55,000 for light and water plants have been voted by residents of this city.

STOCKTON, CAL.—Electroliers will be installed shortly in Bours Park. The property owners of the district are to pay for the installation.

PORT ANGELES, WASH.—A contract for furnishing the county with \$2000 worth of fixtures has been awarded to H. E. Gleason Company, Seattle.

SHOSHONE, IDAHO.—It is intended by the board of trustees to install the new nitrogen lights for street lighting, doing away with the present arc lights.

BELLINGHAM, WASH.—Fifty additional electric street lights will be placed in different parts of the city this month. These lights will all be of the incandescent type.

SPOKANE, WASH.—E. D. Couch, secretary of the Flathead Petroleum Company will superintend the installation of an electric light system at this company's camp.

MONTESANO, WASH.—The county commissioners have granted a franchise to L. H. Burnett to lay gas mains along Olympic highway between Aberdeen and Elma, via Montesano.

FRESNO, CAL.—The council is now gathering information on different designs of electroliers. Bids for this work will be called for in a few days. The system will cost about \$45,000.

SOUTH SAN FRANCISCO, CAL.—It is the intention of the board of public works to have the electrolier system of

lighting along both sides of Grand avenue installed as soon as possible.

TACOMA, WASH.—A contract for furnishing the city with \$10,000 worth of incandescent lamps has been awarded by Commissioner Drake to the Home Electric Company of Tacoma.

LOS ANGELES, CAL.—An ordinance for lighting Main street, between Pico and Thirty-sixth street, and portions of Washington and Jefferson streets has been adopted by the city council.

PORTLAND, ORE.—J. R. Wood, purchasing agent, has been authorized to call for bids for remodeling the lighting system in Peninsula park and the installation of a lighting system in Columbia Park.

ANACORTES, WASH.—The towns of Edison and Blanchard in Skagit County, Washington, are to be electrified. The poles are already in place and the houses are being wired and lights will be available early this month.

ALHAMBRA, CAL.—The lighting committee is considering a proposition made by the Little Rock Power & Water Company to furnish electric current to the city. The company has a power site 27 miles north of Alhambra.

PASADENA, CAL.—Work has been started on the ornamental lighting system for Madison street from Fillmore to Glenarm, residents having arranged with the municipal lighting system to install lamps and build conduits.

PORT TOWNSEND, WASH.—Improvements have just been completed on the Point Wilson lighthouse here, including a new tower and a new high-power lense. The old lighthouse on Point Wilson had been in operation since 1880.

LOS ANGELES, CAL.—The city council has denied all protests against installation of ornamental lighting system in Harvard boulevard between Sixteenth and Washington streets. The total cost of the system will aggregate \$1642.40.

SEATTLE, WASH.—Superintendent Ross of the municipal lighting department reports that over 2,170 contracts were taken out for this service, over 1100 of these being for new business. According to Superintendent Ross this is due entirely to the steady, healthy growth of the city.

SEATTLE, WASH.—Mayor Gill promises to veto any appropriation made by the city council for the extension of the city lighting system outside the city limits. He takes the stand that, until every citizen who wants light is served, no attempt should be made to extend the system outside the city.

HUBBARD, ORE.—It is expected that within a few months the Portland Railway, Light & Power Company, from their base at Salem, will install a competitive system of electric lights in Hubbard. The present current is furnished by the Molalla Electric Light Company, of Canby. It is said that their service is poor and that the rates are exorbitant. The Railway Commission will hold a session next week in Hubbard to investigate the claims of losses sustained by the creamery and several mills through lack of electric power.

TRANSMISSION.

FALL RIVER MILLS, CAL.—Equipment is arriving for the new power plant to be installed by the California Power & Manufacturing Company, which purchased the electric light plant and water rights from Florin Bros. last spring, and also purchased the Florin flour mill.

SAN DIEGO, CAL.—The county board of supervisors has under consideration an application of the Escondido Mutual Water Company for a franchise to build an electric trans-

mission line from the power plant on San Luis Rey River to the power plant below the reservoir and then to Escondido.

LOS ANGELES, CAL.—The Union Hollywood Water Company has made another proposition to the city water board for the purchase of its system by the city. The company offers to sell its entire plant and system within the city for \$750,000, on a monthly payment basis. The city offered to purchase such portions of this system as it desires, but its offer was rejected.

OCEANSIDE, CAL.—The South Coast Land Company has opened negotiations with the Oceanside Electric Company for the extension of light and power wires to South Oceanside and Carlsbad, to which sections the land company is carrying water for irrigating and domestic purposes from the San Luis Rey River. Water is to be pumped from the San Luis Rey River bottom and lifted to reservoirs on the south bank of the river and then distributed to the extensive lands of the company south of Oceanside.

TRANSPORTATION.

SAN FRANCISCO, CAL.—A contract has been awarded for furnishing a quantity of track specials for the municipal railways system, to the United States Steel Products Company for \$6161.

SPOKANE, WASH.—Building committee of Whitworth College favor construction of car line with steel rails and gasoline cars to serve the college.

EASTON, CAL.—Surveyors are at work laying out the route of extensions of the Easton electric railroad, which is to run along the present route of storage battery road from the station to Burlingame Hills.

OAKLAND, CAL.—On November 1st a new schedule went into effect calling for five trains every hour from the Fourteenth and Franklin station of the Southern Pacific in Oakland. Two of these trains come to San Francisco by way of Alameda mole, leaving the station at 5 minutes and 35 minutes after the hour. Three trains come through Oakland along Eighteenth street and to the Oakland mole. The necessity of transferring at the Sixteenth street station is eliminated. These three trains will leave Fourteenth and Franklin 15, 35 and 55 minutes after the hours.

BERKELEY, CAL.—In compliance with the agreement reached between the city and the Key Route officials regarding the paving of Grove street, the city council has passed a modified paving ordinance requiring the company to lay concrete girders under the tracks on that street in place of a solid concrete mattress ordered in the ordinance which the council refuses to pass. The hearing in the matter of the injunction restraining the city from stopping the Key Route trains will be held in the U. S. District Court on December 14th, according to the agreement entered into by counsel for both sides. The temporary orders remains in force.

SEASIDE, ORE.—Preliminary steps have been taken toward the establishment of an electric interurban line from this city to Astoria as to the first link in a comprehensive Coast system of electric lines. The city council was asked to extend the time limit on a franchise through this city that is held now by O. W. Taylor. Prior to the presenting of the request to the council, considerable work had been done by interested residents of Seaside and Astoria in securing data and it is believed that practically all the necessary right of way can be had gratis and that at least part of the cost of the line can be secured in the immediate vicinity.

FRESNO, CAL.—Work on the construction of the Fresno Interurban line to extend from Fresno avenue by way of the Normal School to Gould Colony will be commenced within the next few days. This line will be about two miles long. Construction work on a ¼ mile extension to the present Clovis line will be begun during the next two days. It has been rumored that a 12 mile branch line of the Interurban

from Barton's vineyard to Centerville will be constructed on the main line to Clovis. J. H. Crossett, who has been general manager of the Interurban, has resigned and will become consulting engineer for a road in the South. John McCaffery, who has been connected with the firm of Mahoney Bros., will succeed Crossett as manager.

PORTLAND, ORE.—In consequence of the order issued by the county commissioners requiring the United Railways Company to remove its tracks and vacate the right of way over the Linnton road on February 1st, it is regarded as probable that the company will abandon its service over that route to Linnton at least. It has been suggested that gas-electric equipment might be used over the tracks of the Spokane, Portland & Seattle Railroad to Linnton and its present electric equipment operated from Linnton to the terminus at Wilkesboro. Such a plan would involve the construction of only a small strip of track near Linnton. Just what steps will be taken to meet the present situation will be announced probably within the next few days.

TELEPHONE AND TELEGRAPH.

HANFORD, CAL.—Farmers of Burrel are planning to connect with Riverdale and the trunk telephone line by means of a farmers' line.

PORTLAND, ORE.—F. H. Crosby of San Francisco has purchased the stocks and bonds of the Northwestern Long Distance Telephone Company, representing the holdings of the Pacific Telephone & Telegraph Company, for \$360,000. The sale was officially approved by Judge Bean in the Federal Court. This marks the end of the government's anti-trust suit, waged for several months against the Bell companies in the Pacific Northwest, and fulfills a decree entered by Judge Bean, March 26 last, dissolving the merger and ordering the Bell companies to sell their holdings at Spokane and their Northwestern long distance properties in Oregon and Washington. The properties included lines on the east and west sides of the Willamette Valley, extending from Corvallis on the south through Portland and Southwestern Washington to Tacoma and Seattle on the north.

WATERWORKS.

CLYDE PARK, MONT.—The special election held here to vote on the issuance of \$19,000 bonds for the installation of a waterworks system resulted in favor of the proposition.

AMITY, ORE.—G. T. Morgan, a contractor from Portland, was in Amity recently interviewing the city council relative to waterworks. Mr. Morgan has just completed the waterworks system at Lafayette.

LOS ANGELES, CAL.—The report of the superintendent of county machinery on specifications for improvement work in the Westlake lighting district has been referred to the lighting committee of the district.

BOISE, IDAHO.—The Boise Artesian Hot and Cold Water Company will extend its waterworks system to cover the south side section. It proposes to build a line across Broadway bridge and lay mains to serve all settled parts across the river. The proposed work will cost about \$20,000.

HOOD RIVER, ORE.—Judge W. L. Bradshaw overruled the petition filed by the Oregon Lumber Company asking for a writ of injunction restraining the East Fork Irrigation District from appropriating additional water from Hood River claimed by the Oregon Company. The ditch company will begin at once to enlarge the ditch.

CALEXICO, CAL.—Three bids for the construction of the proposed sand filter and washer for the local water system were received by the city council. Bids were received from P. L. Hedrick of El Centro, Rice & Dutcher of Imperial, and Blaisdell Filtration Company of Los Angeles. The prices were \$4969, \$5312 and \$5000. The bids were laid over for further consideration.

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906 at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXIII No. 20

SAN FRANCISCO, NOVEMBER 14, 1914

PER COPY, 25 CENTS

SUBSTATION FOR SEATTLE MUNICIPAL RAILWAY.

BY H. J. KENNEDY.

INDUSTRIAL USES OF FUEL OIL.

BY F. B. DUNN.

STANDARDS IN SAN DIEGO.

BY L. M. KLAUBER.

COST ACCOUNTING.

BY O. B. COLDWELL.

MATERIALS ADVERTISED IN THIS ISSUE

Are Lamps

General Electric Co.

Batteries

Edison Storage Battery Supply Co.

Boiler Feed Water Treatment

Dearborn Chemical Co.

Diesel Engines

Busch-Sulzer Bros. Diesel Eng. Co.

Electrical Instruments

Weston Electrical Instrument Co.

Governors

Pierson, Roeding & Co.

Heating Appliances

Pacific States Electric Co.
Simplex Electric Heating Co.

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Pierson, Roeding & Co.
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Wagner Electric Co.

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PACIFIC STATES ELECTRIC CO.

The Modern Electrical Supply House

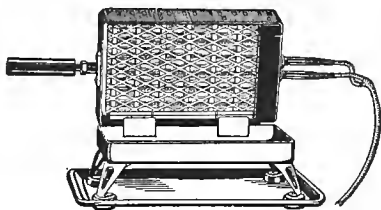
Distributors for the Pacific Coast

LOS ANGELES OAKLAND PORTLAND SAN FRANCISCO SEATTLE

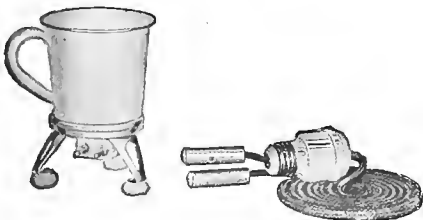
Member Society for Electrical Development—"DO IT ELECTRICALLY"



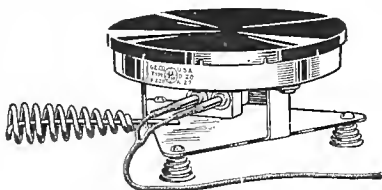
Electric Percolator



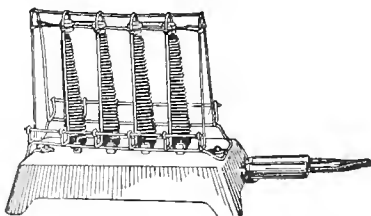
Electric Grill



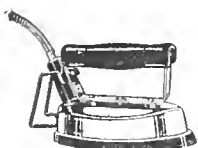
Electric Shaving Mug



Electric Disc Stove



Electric Toaster



Electric Iron



JOURNAL OF ELECTRICITY

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SUBSTATION FOR SEATTLE MUNICIPAL RAILWAY

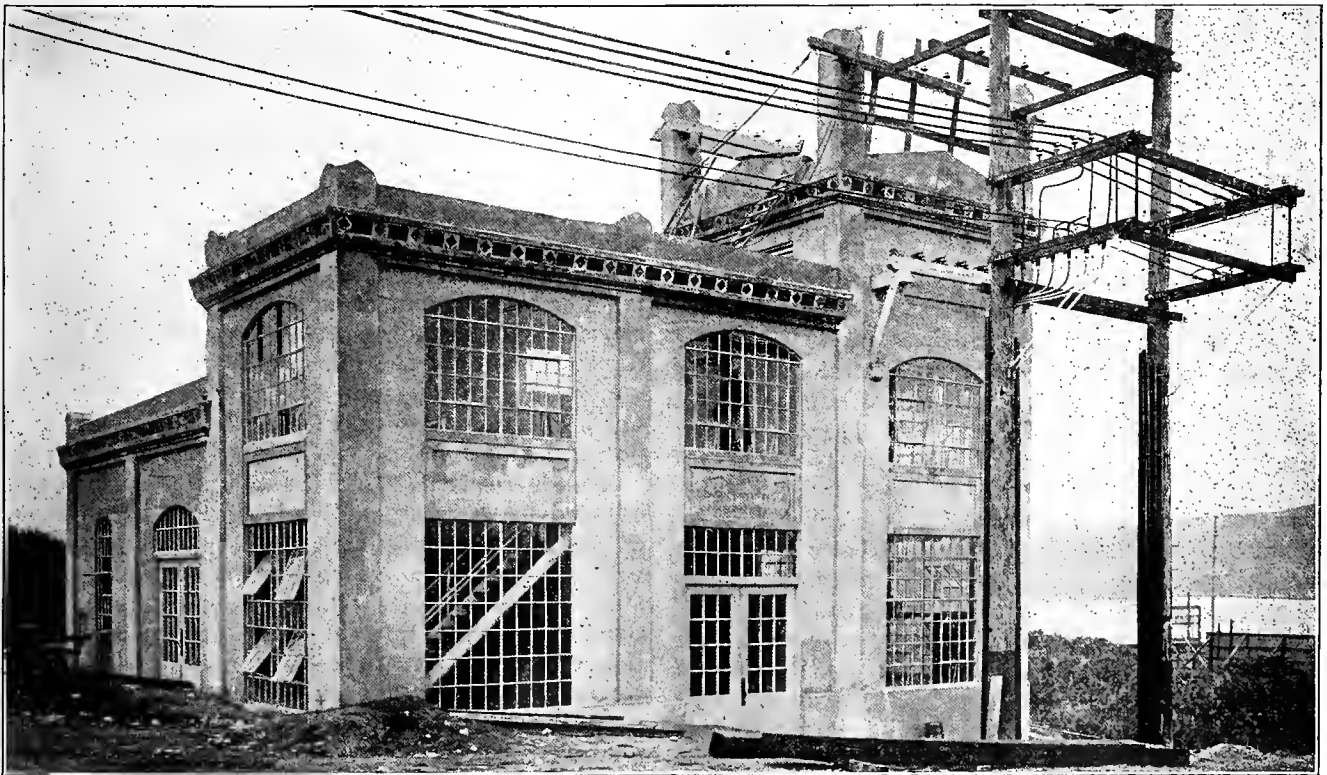
BY H. J. KENNEDY.

(This description of the substation supplying power to Seattle's double trolley municipal street railway system gives the reasons for adopting several innovations in equipment, including the use of motor-generator sets with three wire generators and synchronous motors, double pole circuit breakers and electrically-operated remote control. The author had charge of the design of the station and the installation of the equipment.—The Editor.)

Late in the spring of 1913, the Seattle council approved a site selected by the engineers for a substation, and plans were made for a reinforced concrete structure. The generators, switchboard and other electrical apparatus had been ordered, and in the fall the building was started, and completed by the end of

cordingly laid out on more liberal and substantial lines than if it had been a mere temporary station to supply a few miles of railway.

The substation is situated near the electrical center of Division "A" on a lot 70 x 121 ft. at the north-easterly corner of Dexter avenue and Aloha street.



Seattle Municipal Railway Substation.

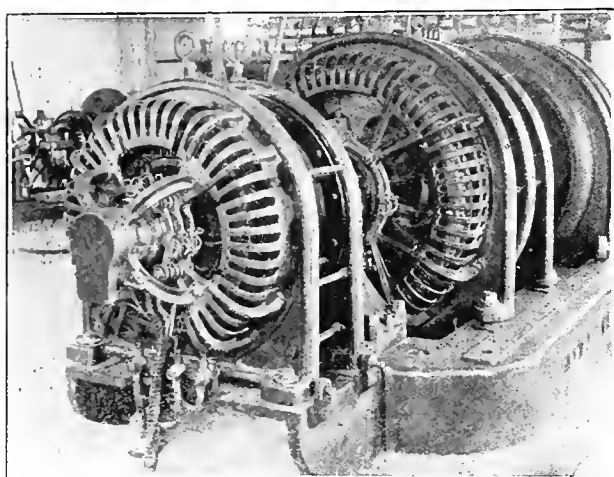
winter. It should be borne in mind that this substation, though built by and for the municipal railway, with prospects of railway extension, was also designed with a view to its utilization by the city lighting department as a distributing point for direct current, as hereinafter explained. It was ac-

The building is of reinforced concrete, walls and floors being column, beam and slab construction, roof trusses steel, roof of reinforced concrete and steel floor tile construction. It is a one-story building except in front, where a gallery or second floor occupies the whole front, being made extra high at the southeast-

erly corner, forming a tower room into which the high tension wires come and in which are housed the high tension buses, switches, transformers and other apparatus. The building is, in plan, 50 ft. square over corner columns, which are 2 ft. square and project 4 inches outside of the 6 inch wall.

A pit 6 ft. deep from floor of generator room extends along the east wall of the building back of the switchboard. Concrete buttresses 10 in. thick adjoin the two columns in the east wall, and serve to support a 10-in. I-beam paralleling the wall at the floor level, which carries the structural steel supports for the circuit-breaker panels, and the d. c. buses, and also supports the floor back of switchboard. The circuit-breaker panels are distant 4 ft. 8 in. from wall to their backs.

The station is equipped with an electrically operated remote control; the control switchboard being



Motor End of No. 1 Motor Generator.

placed with its back nine feet from the east wall, the panels being all grouped together in the middle of the building.

The two 500 kw. motor-generators are situated with their axes parallel; the foundations are mass concrete, 1:3:5; they are 7 ft. by 15 ft. at the top, built with a batter of 15 in. in 7 ft. and extending well down into the original soil below bottom of fill. A pit 10 ft. 6 in. in length, and 4 ft. deep, is formed in each machine foundation. The widths of pit are 2 ft. 9 in. and 3 ft. 6 in. at the motor and generator ends, respectively. The foundations were put in by the building contractors, the anchor bolts and cable conduits were put in by day labor under the supervision of the city's engineers and foremen.

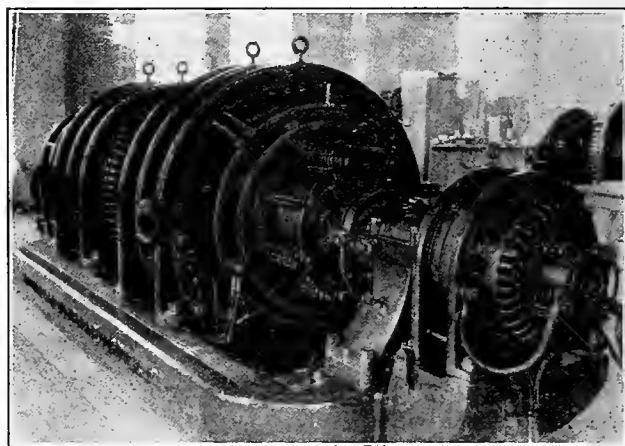
Between the machine foundations is formed a pit 6 ft. 6 in. deep with 8 in. concrete walls, with a beam and slab (5 in. thick) reinforced floor over it. This pit is reached through a 33 in. opening in a man-hole frame with cast-iron cover, and contains concrete blocks to support the balancing coils as near as possible to their respective three-wire generators, to minimize the length of lead between the coil and the armature, to assist good regulation. The cables for the induction motor wiring also run in this pit. The pit is roomy and convenient for working in, even more so than required by the state manhole law. An opening or tunnel 4 ft. by 5 ft. extends from it into the large pit

back of switchboard, serving partly for ventilation, partly for running wires and partly for access.

The combination of four machines in each motor generator set, and the fact that the generators are three-wire, makes necessary an installation of numerous conduits to lead from the machines to the pit. Where the conduits could be embedded in concrete, as in the machine foundations, pit walls, etc., Orangeburg fibre conduit from 2 to 4 in. in diameter was used; elsewhere iron conduit is installed; lead covered cables run through these conduits, thus the wiring is thoroughly protected.

Electrical Equipment.

The Aloha street substation was designed to form part of the municipal electrical distribution system, centering in the Yesler Way substation at the city end of the two 60,000 volt transmission lines from the



Exciter End of No. 1 Motor Generator.

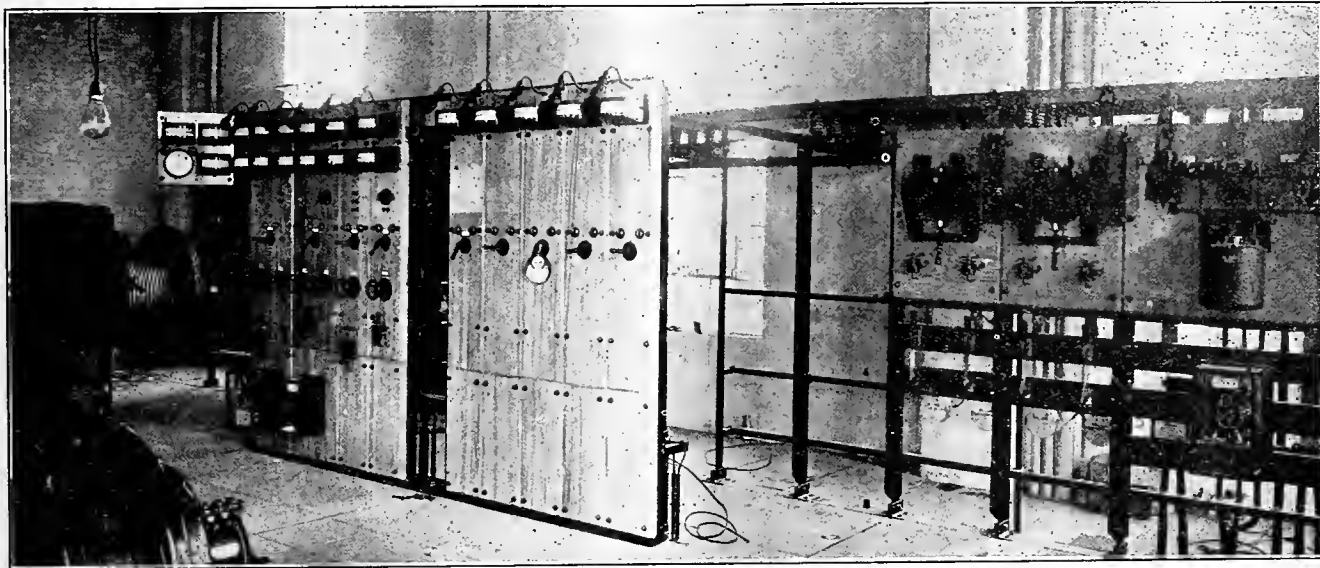
hydroelectric plant at Cedar Falls in the mountains. The distribution from Yesler Way to the various outlying substations is at 15,000 volts, two-phase, five wire (grounded neutral). These substations are transformer stations principally for lighting but also carrying a certain amount of motor load. When the necessity arose for installing converting apparatus to supply direct current for the railway, it was thought a good opportunity to help out the light department by acquiring condensing apparatus to help hold up the power factor on the city lines. Hence synchronous motors were used rather than rotaries, as being well adapted to this purpose, with the special advantages of synchronous machines, such as independent d.c. voltage regulation. To reduce the disturbance due to starting the machines, which would result from using the large motors to start themselves, a small induction motor was mounted on the shaft with the synchronous motor and provision made to regulate its speed by a Cutler-Hammer multiple-switch starter and resistance box connected to the secondary or wound rotor of the induction motor. The synchronous speed of the induction motor being 900 r.p.m., the shaft can readily be brought up to or above the synchronous motor speed of 720 r.p.m. The starter is located in front of the switchboard, so that the operator can watch the synchroscope and readily reach the handle controlling the synchronous motor oil-switch.

It is intended at some future date, when the ratio

of total generating capacity of the city's power system (which capacity is being increased) to the load of this substation, has become much greater than at present, to discontinue the use of the induction starting motor, and instead to use the following arrangement to make the synchronous motor start itself:

Brass end plates are attached to the field coils of the synchronous motor in such form as to make it virtually a squirrel cage induction motor rotor. By means of auto-transformers with 30 per cent taps, and oil switches, with resistances in series with the transformers part of the time, step by step application of current to the stator can be made, until the rotor is

current to the Aloha street substation. The expense for station operators is at present defrayed by the railway. To the fact that the men are habituated to handling remote-controlled switchboards, are to be added the greater convenience and safety in having the heavy current and high tension apparatus at a distance from the operator. Moreover, future extension and addition of other apparatus is facilitated, without interfering with a convenient switchgear grouping. The high tension apparatus is particularly well disposed, being grouped in a tower room by itself, screened off by wire mesh allowing free ventilation, and all the apparatus being under observation—much



Control Switchboard and Circuit Breaker for No. 1 Motor-Generator.

brought to synchronous speed, when the motor is thrown directly on line and the starting apparatus cut out.

The use of three wire generators was to meet the request of the lighting department that provision be made for supplying them 300 volt direct current for motor loads. The neighborhood of the shore of Lake Union (two blocks from Dexter avenue, where the substation is located) has already commenced to be an industrial district: various manufacturing establishments have been erected, including the large assembling factory of the Ford Motor Company; the Northern Pacific Railway has built a Belt Line and yards and freight house, it is understood that the C., M. & St. P. has acquired a large area for similar purposes, and it is believed that a future large demand for power both a.c. and d.c., may be anticipated in this district. The lighting department is already supplying 250 volt current (principally for elevator motors) from its Yesler Way substation; and the addition of similar facilities in the Aloha street plant puts the department in a much stronger position to make contracts.

The remote control was used principally to follow the practice established in the power stations and substations of the lighting department, to which the operators had become accustomed. This department did not, of course, design or build the Aloha street station, though it was designed to be operated by station men furnished by the lighting department, which, in selling power to the railway, delivers alternating

of it from the ground floor—without the necessity of entering the room.

There are at present installed two generating units, built by the Ridgway Dynamo & Engine Company, Ridgway Pa., each consisting of the following four machines on the same shaft:

One 540 k.v.a., 722 h.p., two-phase, 60 cycle, 720 r.p.m., 7500-volt, ten-pole, revolving-field synchronous motor, taking 38 amperes per line at full load and 100 per cent power factor.

One 500 kw., 600-300 volt, revolving armature, three wire generator, delivering 833 1-3 amperes direct current at full load.

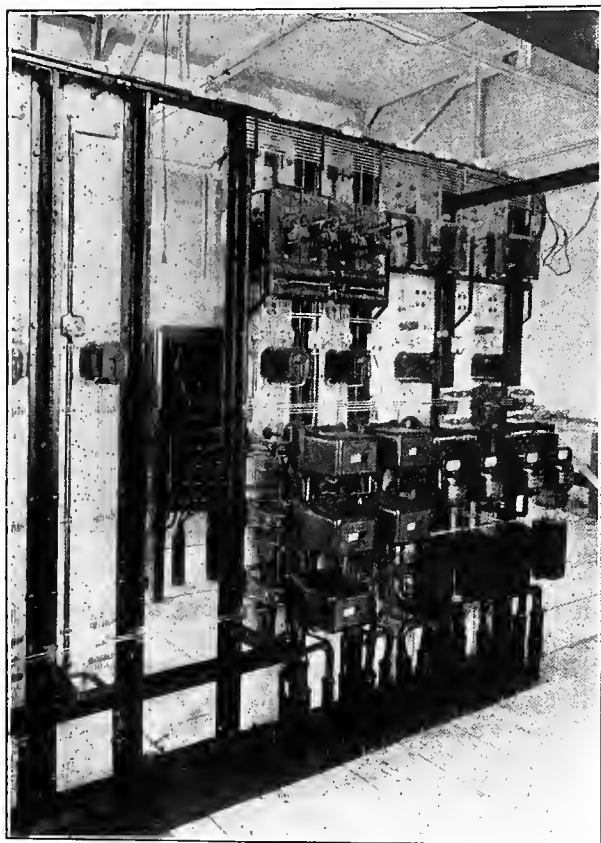
One 75 h.p., two-phase, 60-cycle, 230 volt, slip-ring or wound rotor induction motor, for starting the unit, the rotor being mounted on projecting end of shaft, and stator supported on bracket from main bed of machine. Its synchronous speed is 900 r.p.m.

One 10 kw., 80 ampere, 125 volt d.c. generator to excite the motor field, the armature being mounted on projecting end of shaft, and field frame being supported on a bracket from bed of machine.

The shaft is supported by three bearings, one between the motor and generator, one between the generator and exciter and one between the synchronous motor and the induction motor. The unit is 18 feet long over all, 6 ft. 1 in. wide, and has a shipping weight of 46,000 lb.

In the illustration of the exciter end of No. 1 motor generator in front of the generator commu-

tator, two slip rings may be seen mounted on the shaft; they are connected to electrically opposite points of the armature winding. From the carbon brushes making contact with these rings, connections are made to a Thompson-Ryan balancing coil, which prevents difficulty from sparking and armature reaction when the 300 volt loads are unbalanced. The balancing coil is intended to be capable of carrying continuously in the neutral, 25 per cent of the full load current of the generator, without exceeding the specified full load temperature of generator. The neutral is connected to the middle point of the coil and led through the generator breaker to the neutral bus. The coil has been located in the basement close beside the



Rear View of Control Switchboard.

machine foundation, to minimize the length of lead to machine and improve the regulation. It was specified that under the extreme unbalanced condition named, the variation of e.m.f. on either side of the neutral should not be greater than two per cent of the mean.

The generator is over-compounded 50 volts between no load and full load. The series fields are split, one-half being connected to positive brush and the other half to negative brush. In like manner, there are connections to positive and negative equalizing bus bars, and there are ammeters on both sides of the circuit with their shunts mounted on the machine.

Switching Apparatus.

This substation, for the reasons intimated, has been substantially built of reinforced concrete, the north wall being brick and readily removable for extension of the plant. The machines are placed with their axes east and west. An indefinite number may be added in extending the station, still preserving the

same arrangement. The switchboard arrangement is also designed with a view to facilitating extension; the control switchboard is placed east of the machines, extending north and south, at a distance of 9 ft. from the east wall. The circuit-breaker panels are placed back of this, and in line with them at the southeast corner of room is the lighting switchboard.

Each panel on the control board carries a remote control switch, and the a.c. panels are equipped with wattmeters, ammeters, field ammeters, power factor meters, voltmeter and synchronizing receptacles, field switches, and the usual rheostat mountings, as well as a graphic wattmeter and watt hour meters.

The two d.c. ammeters per machine are mounted on their generator panels; the voltmeter is on swinging bracket panel. Back of the generator panels are mounted the inverse time limit overload relays and reverse current relay for operating circuit breakers, which with the remote control for the feeder-panel circuit-breakers can be seen in the rear view of the control switchboard.

The generator carbon circuit breakers are three-pole breakers operated by one solenoid, with two additional contacts for the equalizers. Some of the feeder breakers are seen in the same picture; they are also carbon and solenoid operated and are double pole. The generator breakers are rated at 2000 amperes each and the feeder breakers at 800 amperes.

There are five d.c. buses back of the circuit breaker panels. They are formed of 3 in. by $\frac{1}{4}$ in. copper bars, two bars to each of the two mains, one bar to each equalizer, and one to the neutral. The two bars next the wall are the equalizers. Connections to line are made through pit and underground iron conduits to poles on street.

The High Tension Gallery.

The high tension gallery in this substation is conspicuous for visibility and accessibility to all the apparatus, the orderly arrangement and ease with which connections can be followed out, making it practically impossible for an electrician to make an error as to the identity of any particular conductor. Housed in a concrete room reached by an iron staircase, it is fireproof, bright and cleanly. The pole disconnecting switches, horn gaps and electrolytic lightning arresters are mounted outside.

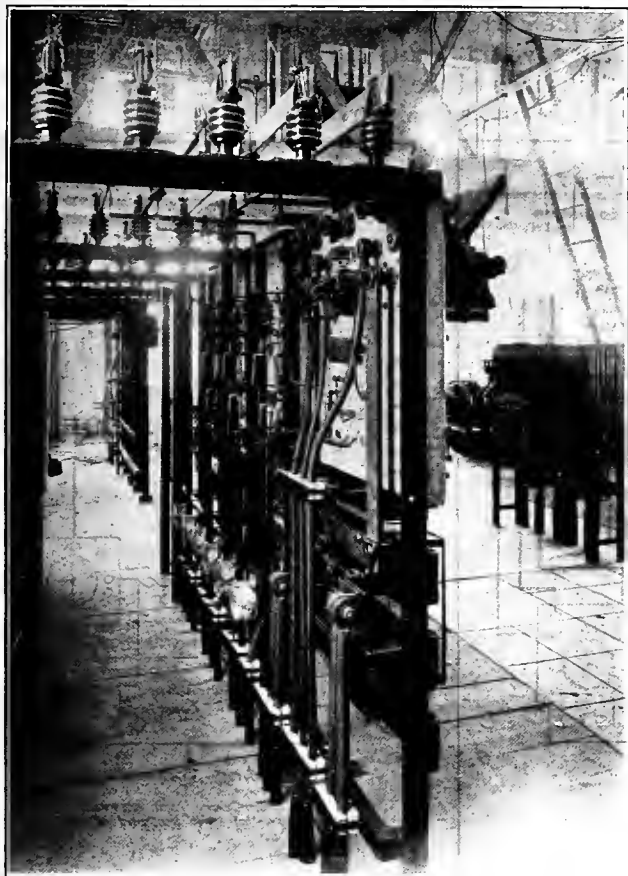
The buses extend north and south across the tower room. Taps taken off them give two-phase systems for synchronous and induction motors of 7500 volts between mains and neutral; thus reducing voltage one-half without use of transformers.

Two 7500/250 volt transformers in the high tension room supply current to the induction starting motors already mentioned. These transformers are fed from the high tension buses through a set of three expulsion fuse type disconnecting switches, and are connected open delta on the high tension side, and two-phase four-wire on the low tension side.

The Cutler-Hammer starters (electrically connected to rotors) are mounted side by side on a frame. Below them is a double throw four pole switch connected to the stator windings of the two induction motors. This switch is thrown in the direction of whichever machine it is desired to start, and then the

starter is manipulated as already described. In practice it is found that more accurate speed regulation for synchronizing can be obtained by exciting the generator field and regulating the latter, using it as a magnetic brake, this being done after cutting out two successive steps on the starter rheostat. A Westinghouse synchroscope and synchronizing lamps are provided on the swinging bracket panel, and the operator, stand-

lighting circuits on either the 120 volt a.c. line or on the exciter circuit, enabling the station to do its own lighting irrespective of any trouble on the a.c. lighting distribution lines. Below this switch are knife switches for the various circuits. From each of two roof trusses are hung three 100 watt Mazda lamps, with another in the middle of the room, and additional lamps on brackets on wall of room. Lamps are of course pro-

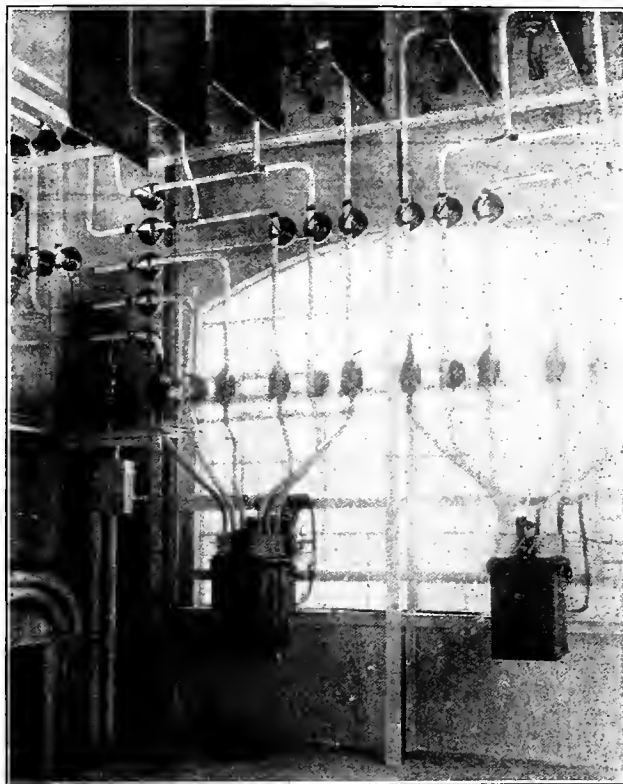


Rear View of Circuit Breaker Panels and D. C. Buses.

ing with all the appliances for starting and synchronizing within reach from one spot, can get the machine into step very readily.

All of the switchboard panels so far mentioned are of polished blue Vermont marble, and the indicating instruments, except the synchroscope, are of the General Electric horizontal edgewise type, to conform to the style adopted in the city light department plants. The connections are made on the assumption that the synchronous motors will operate in parallel from the five wire two-phase system—the 7500 volt circuits, however, being derived from alternate phases of the 15,000 volt distribution system; that the generators will operate in parallel on the same buses; and that each motor can be excited by its own exciter. The current and potential transformers for the various instruments, relays, etc., are located in the high tension gallery. The chain operated rheostats are in the pit back of switchboard.

The night lighting of the station is excellent. That shown in the illustrations is only temporary. From a pole transformer outside, power is led to the lighting panel, on which are mounted the watt hour meter and a double pole double throw switch for throwing the



Oil Switches for Synchronous Motors.

vided for the basement pits, gallery, telephone booth, toilet, switchboard and outside over entrance doors on three sides of building.

The largest P. P. I. E. exhibit thus far received is that of the U. S. Steel Products Company. This exhibit has been given three quarters of an acre of space at the south end of the Palace of Mines and Metallurgy and the work of installation has begun. The exhibit consists in large part of big models of factories and mills properly lighted with modern hygienic appliances. Wax models also will be added to demonstrate proper hygiene and general welfare of workmen.

Smokeless combustion of oil is not difficult with a properly designed furnace and a boiler not overloaded in proportion to the capacity of the furnace. It is necessary to supply sufficient air and to have a constant pressure and temperature in the oil supply, the temperature not being too low. Maintaining these standard conditions are far easier than with coal firing. An excess of air is almost as detrimental to efficiency as a deficiency so that it is usually considered good practice to reduce the air supply until smoke just begins to appear.

ELECTRIC DISTRIBUTION

STANDARDS AT SAN DIEGO.

Section H—Meters.

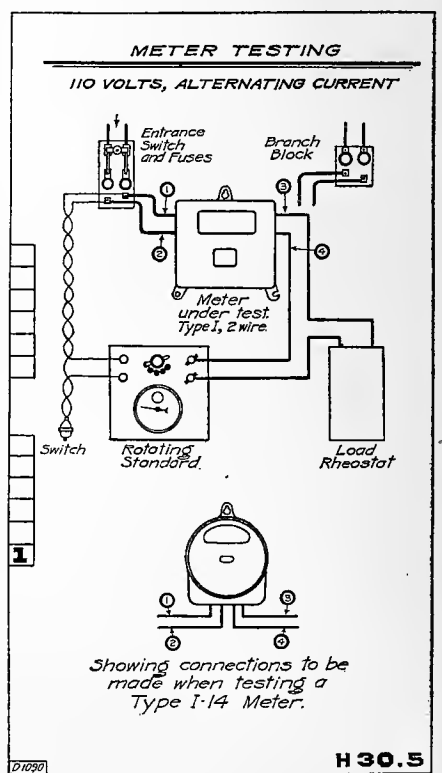
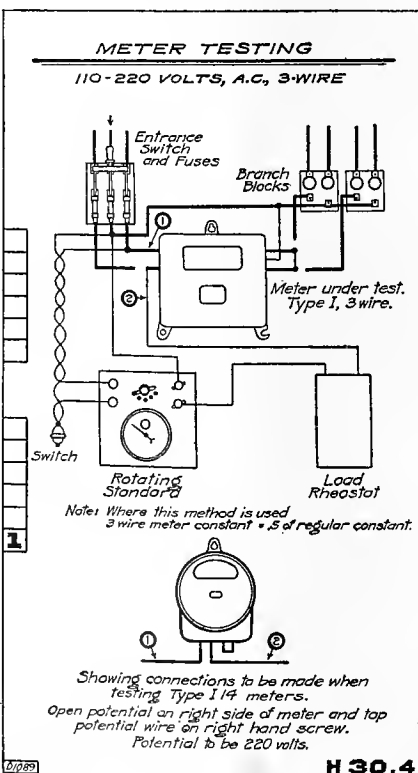
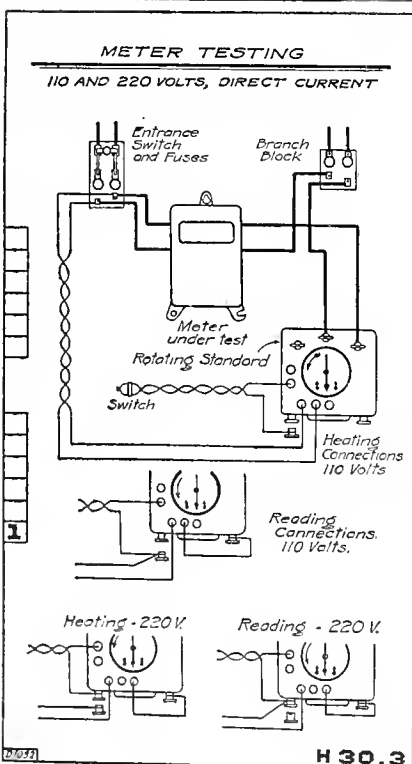
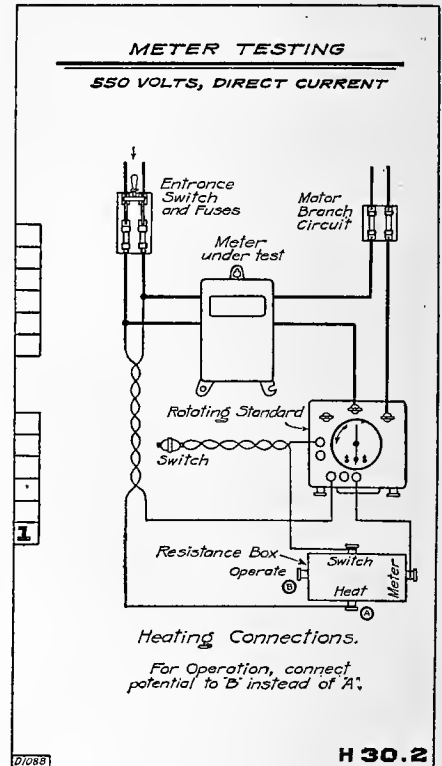
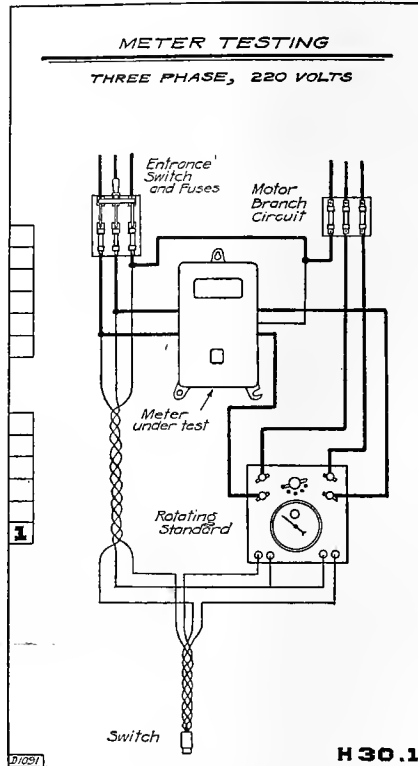
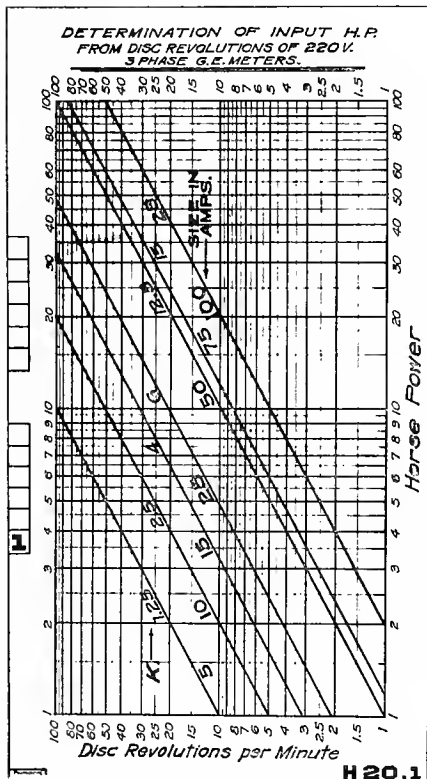
BY L. M. KLAUBER.

[Continued.]

H 20: H.P. Calculations. This curve sheet permitting the determination of horsepower input directly from the disc revolutions of the meter is serviceable in testing.

H 30: Meter Testing. Diagrams are inserted for meter testers, together with the schedule of tests shown in H 30.9.

H 50: Current Reading Loop. This loop shown in Sheet H 50.1 is found of value at small out-door transformer stations (150 k.v.a. or less) having 2300 volt secondaries. In making load tests at such stations, the current is usually too light to give accurate readings with a "split ring" transformer and ammeter, but by means of the loop the observed current is made four times the actual current.



H 30.7—Meter Testing. Schedule of Tests.

- Three Phase and 500 Volt D.C.
2 Minute Run at 10% Load.
1 Minute Run at 50% Load.
1 Minute Run at 100% Load.
- Single Phase and 110-220 Volt D.C.
1 Minute Run at 10% Load.
1 Minute Run at 50% Load.
1 Minute Run at 100% Load.

In large three phase installations the meter with current and potential transformers should be tested as a whole, using standard instrument transformers and rotating standard.

H 40.1—Meter Constants—Load Determinations from Watthour Meter Readings.

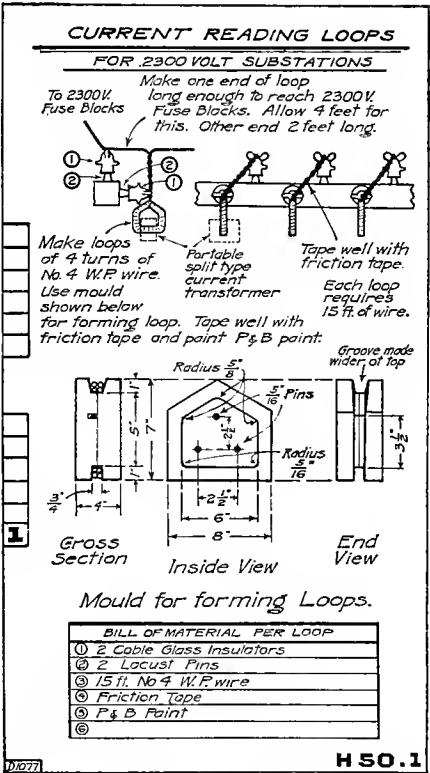
Meter Size Amperes.	K	H.P. per Disc Rev. per Min.
Three Phase, 220 Volts, Type D3.		
5	1.25	.1
10	2.5	.2
15	4.	.32
25	6.	.48
50	12.5	1.0
75	15.	1.2
100	25.	2.0
150	30.	2.4
Three Phase, 440 Volts, Type D3.		
5	2.5	.2
10	5.	.4
15	7.5	.6
25	12.5	1.0
50	25.	2.0
75	30.	2.4
100		

Three Phase, 110 Volts, Type D3.
Used on 2200 Volt Installations.
5 .6 .048

Multiply by ratio of current transformers time ratio of voltage transformers.

Single Phase, Type I. 110 Volts.		
Meter Size Amperes.	K	Watts per Disc Rev. per Min.
3	.2	12
5	.3	18
10	.6	36
15	1.	60
25	1.5	90
50	3.	180
75	5.	360
100	6.	360
150	10.	600
200	12.5	750
220 Volt, 2 or 3 Wire.		
3	.4	24
5	.6	36
10	1.25	75
15	2.	120
25	3.	180
50	6.	360
75	10.	600
100	12.5	750
150	20.	1200
200	25.	1500

Formula: $\text{Watts} = \frac{K \times 3600 \times \text{Revs.}}{\text{Seconds.}}$



WATER POWER SURVEYS IN SNAKE RIVER BASIN.

Topographic engineers of the United States Geological Survey have been making profile surveys in the Snake River basin, Idaho—surveys incidental to their general topographic mapping—and the results of their work have just been published by the Geological Survey in Water-Supply Paper 347, which contains also a map of the area examined.

The Snake River basin contains many good storage sites but only a few have been utilized. About 400,000 acre-feet of water can be stored in Jackson Lake by a dam which has been constructed by the Reclamation Service. The largest site is at Swan Valley, on Snake River, where the water available for storage is approximately 4,000,000 acre-feet. Irrigation has reached a high stage of development in the Snake River valley, yet approximately 6,000,000 acre-feet of water annually runs to waste. Eventually these flood waters will be stored and used to irrigate thousands of acres of arid land. The streams afford enormous water powers, but only a few sites have been developed owing to the lack of market.

More than 80,000 exhibits have been accepted by the Panama-Pacific International Exposition, and are now being installed in the various exhibit palaces. These include displays of every form of human activity and are representative of the various industries of the world. As far as possible, all the exhibits will be in actual operation or "working." In the case of machinery exhibits, all will be shown under actual working conditions and various parts and accessories will be shown in use in connection with other exhibits.

Oil cargoes may pass through the Panama Canal without the necessity for obtaining permission in advance.

An appeal for fair play for the New Haven road has been made to the people of New England by a public announcement placed on 2000 or more public billboards. A request is made for a freedom from disturbance, an opportunity for constructive work and the doing away with laws which prevent the adoption of a comprehensive financed plan. In return President Elliott pledges the best efforts of the directors and officers in conducting the affairs of the company in a prudent, lawful and efficient manner, "fully realizing that with only public confidence and support and especially the co-operation of the various commissions and governmental authorities can the success of the company be assured."

The collier Jupiter passed through the Panama Canal October 12th on its way from the north Pacific Ocean to Philadelphia, where it will restock with coal. This is the largest vessel to have passed through the Canal to date and is the only large vessel driven by electricity. The electricity is developed by a turbo-generator, driven by steam, for which oil is the fuel. and transmitted to large motors connected to the twin shafts. The ship's officers say that the propelling system is satisfactory, and effects an economy of about 35 per cent in comparison with the usual systems. Its passage from Balboa as far as Gatun Locks was made in less than six hours, the shortest time yet required for this part of the transit, and demonstrated the smoothness of operation that has been developed in handling vessels through the Canal.

INDUSTRIAL USES OF FUEL OIL.

BY F. B. DUNN.

[Continued.]

Oil Storage.

The situation of the oil storage depends largely upon the kind of tank. Steel and galvanized iron tanks are generally constructed on the surface, the oil flowing by gravity to the oil pumping system, having been pumped from supply cars to the storage tanks.

Galvanized sheet iron tanks are sometimes placed under ground, though this practice is not to be recommended because of the pressure caused by the surrounding earth. Corrugated iron tanks with the corrugations running around the tank are many times stronger than plain tanks and can be safely placed underground.

Re-inforced concrete tanks are used in many places. Great care must be taken in their construction, using only the best cement and clean sand. The bottom should be on a 3 in. bed of oil sand and the inside should be finished with at least $\frac{1}{2}$ in. of cement, and coated with a good waterproof solution.

The size of the storage tank depends upon the estimated consumption of oil. If the plant is a great

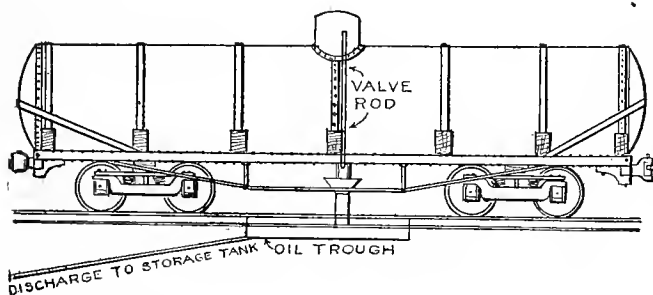


Fig. 5. Gravity Method of Unloading Tank Car.

distance from the source of supply, a storage equal to at least one month's requirement should be constructed.

When the storage is far from the furnaces, it should be arranged to allow the oil to flow by gravity. It is better to pump the oil into the storage than tax the pumps to their capacity by pumping from the storage to the burners. Large suction lines from stor-

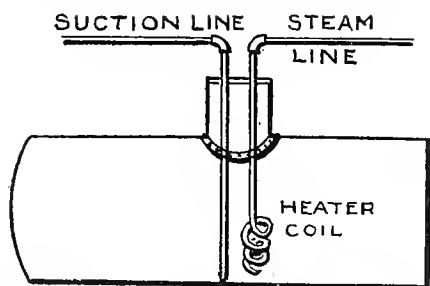


Fig. 6. Connection for Pumping Oil from Tank Car.

age to the pumps are recommended, the diameter of the suction being from 1 to 2 in. greater than the pump suction.

When necessary to heat the oil in the storage tank, this can be best accomplished by 2 in. heating coils, placed near or around the suction, inside of the tank. Pipes through the tanks should be connected by companion flanges securely fitted to the shell, and not a running nipple secured with lock nuts.

Fig. 5 shows the method of unloading a tank car by gravity. Wherever possible a "trough" should be constructed to allow the oil to flow into the storage tank as it obviates the necessity of making pipe connection each time a car is unloaded and prevents the loss of oil before the connection can be made after the valve is opened when some foreign substance has collected under the bottom valve.

Fig. 6 shows the method of pumping the oil from the tank car. In cool weather it is often necessary to heat the oil, and in tank cars having no heating coils, steam connections are made as shown.

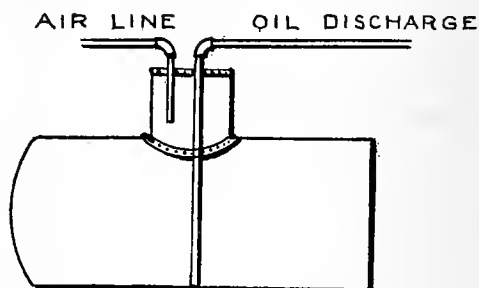


Fig. 7. Compressed Air Oil Pumping from Tank Car.

Fig. 7 shows how a tank car is unloaded by means of compressed air. Care should be taken in using this method as many of the tank cars are only tested to 50 lb. pressure per square inch.

A swing joint and strain should be fitted to the suction line entering the tank; the length of the "swing" being equal to the depth of the tank. The strainer can thus be cleaned after it has been pulled to the opening in the top of the tank. A small drain is necessary at the bottom edge of the tank to drain off the water that settles. A manhole on the top and also at the bottom side is of great advantage when cleaning. Vent pipes must be also provided to allow for the escape of any gas that might form.

The use of naked lights around the storage tanks should be absolutely prohibited. When using portable electric lights care should be taken to see that the insulation is in good condition as otherwise an explosion is liable to occur in case of a spark, due to the wires grounding.

(To be continued.)

The most economical penstock, according to a formula derived by M. W. Warren in a paper to be presented before the December meeting of the American Society of Civil Engineers, has a diameter in feet equal to

$$\sqrt[6]{\frac{3250 q^2 i}{C^2 p B}} \text{ where}$$

q = square root of mean square of flow through penstock, in cu. ft. per sec.

i = income, in dollars per year per ft. of head.

c = coefficient for Chezy formula for friction in pipes.

p = percentage return on investment, including profit, depreciation, maintenance and taxes.

B = cost of pipe in place, per foot of diameter per foot of length.

COST ACCOUNTING.

BY O. B. COLDWELL.

(In further confirmation of recent editorials on this subject the remarks of Mr. Coldwell before the Spokane convention of the Northwest Electric Light & Power Association are here printed.—The Editor.)

The cost of service is now a matter of extreme importance. The commissions are anxious to know what it is costing to furnish the various classes of service which a public utility performs, and it would seem that that matter would be of importance also to the utility companies themselves.

The way in which accounts have been made up in the past readily shows the cost of a substation, miscellaneous supplies, etc., without reference to the cost of those things for the particular class of service which is being rendered. If a substation is serving three different classes of consumers, and you are desirous of knowing what each one of these classes is costing, it would seem desirable to have a set of accounts in which the operating attendance for each is pro-rated or apportioned between each class of service.

W. G. Vincent, valuation engineer for the Pacific Coast Electric Company, in arriving at the cost of various classes of service in the town of Antioch (a small town served by one substation, which has street lighting circuits as well) first found the cost of the substation from the company's records and then using his knowledge of the operating records and properties, getting the same information from the operating people, apportioned this cost to the various classes of service. He made a similar apportionment with the capital accounts. He found out what the apportionment of the fixed charges should be, and was thereby enabled to arrive at the proper apportionment of expense. This might have been ten years after the actual work had been carried out.

I asked Mr. Vincent how it would be if the actual records of the company that were being kept at the time would show on their faces the cost of these various classes of service rendered by that substation. He said it never occurred to him that such a thing might be done, and it was his opinion that had the company kept its accounts in that manner, containing that principle, the work of an investigator, like myself, would have been very materially assisted.

I appreciate that it is a difficult matter to bring into effect the principle which is to a considerable extent different from that which is being applied at the present time. There is a great deal of inertia in all of us, and perhaps that applies more to this accounting end of the business than to those who follow the engineering end of it.

I would be very glad to try to bring about on the part of any of those interested in the matter, a further conception of what we have been driving at. We have "tried it out on the dog" as it were, in Portland by taking a diagram of the various physical locations making up the company's properties, and then laying out on that diagram a set of accounts, and, as a result, arrive at the cost of service to these various physical elements.

CODE OF PRINCIPLES.

Adopted by the American Railway Association at Atlantic City, N. J., on October 14, 1914.

1—The first obligation of public utilities engaged in transportation is service to the public. The first essential of service is safety. Quality of service must primarily depend upon the money received in fares. For this reason it is necessary that the rate of fare should be sufficient to permit the companies to meet the reasonable demands of patrons and to yield a fair return on a fair capitalization.

2—Regulated private ownership and operation of electric railways is more conducive to good service and the public welfare than government ownership and operation because the latter are incompatible with administrative initiative, economy and efficiency, and with the proper development of cities through the extension of transportation lines. The interests of the public are fully protected by the authority given to regulatory bodies.

3—In the interest of the public and good service local transportation should be a monopoly and should be subject to regulation and protection by the state rather than by local authorities.

4—Short term franchises are detrimental to civic welfare and growth because they ultimately check the extension of facilities and discourage good service.

5—In order to render good service, electric railways must be allowed to earn a fair return on a fair capitalization, and the foundation for this result will be obtained if the issuance and sale of securities representing such fair capitalization shall be legally authorized on such terms as will produce the requisite funds.

6—Securities which have been issued in accordance with the law as it has been interpreted in the past should be valid obligations on which an electric railway is entitled to a fair return.

7—The relation of adequate wages to efficient operation should always be recognized, electric railways, being public servants regulated by public authorities, should be protected against excessive demands of labor and strikes.

8—The principle of ownership of securities of local companies by centralized holding companies is economically sound for the reason that the securities of the latter have protection against the varying business conditions of a single locality or company and because money for construction and improvements can thus be more readily obtained.

9—In the appraisal of an electric railway for the purpose of determining reasonable rates, all methods of valuation should have due consideration.

10—Full and frank publicity should be the policy of all transportation companies, to the end that proper information may be available to the investor and the public.

The Washington Water Code Commission has published a report recommending certain changes in the existing laws which will guarantee water titles to the rightful holders thereof. By giving a record title it is hoped to gain confidence from investors in irrigation and power development and put an end to wild-cat speculation in irrigated lands.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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Because of the long ballot submitted at last week's elections in California, Oregon and Washington, complete returns on certain amendments are not yet available. At this time, however, it is possible to announce that the George bill was decisively defeated in Oregon and

Election Results

that the California Railroad Commission has been given jurisdiction over public utilities in incorporated cities. In California it is confidently believed that the Water Commission Act, and the two irrigation measures were passed and that the municipal utilities bill was defeated. Returns to date indicate that the amendment to allow the California Railroad Commission to evaluate condemned public utilities was defeated.

Most of these measures have already been discussed in these columns and it is a matter of interest to note that those which were favored have been passed and those which were opposed have been lost. The irrigation measures are worthy of the special attention given below.

The two measures concerning irrigation districts should strengthen irrigation securities and ultimately redound to the benefits of the companies supplying the power needs of the communities affected.

Irrigation Districts

One relates solely to the Imperial Valley, where 500,000 acres are being irrigated with water from the Colorado River supplied by a canal traversing forty miles of Mexican territory. Under the former law it was not possible for a United States corporation to own that portion of the canal in Mexico. The new law permits the irrigation district to own stock in the Mexican corporation and thus retain control of the water.

The other law is more general, being concerned with state supervision of the affairs of irrigation, reclamation and drainage districts. The purpose is to especially supervise the expenditure of money for construction purposes in order to assure investors that their money will be wisely spent. With the wider market thus made possible the community will be more rapidly developed and the central station income correspondingly enhanced.

In irrigation the difficulties of finance have always been far greater than those of management and operation. The engineering and legal problems have been insignificant compared to the financial. It is less difficult to make a mine pay "from the grass-roots down" than to create a farm from an original condition of aridity and at the same time pay off the interest and principal on irrigation bonds. Irrigation securities command a high rate of interest and are not always readily salable because the confidence of investors has been weakened by default of irrigation districts.

An irrigation project of good engineering design and construction can be made one of the safest investments open to capital. It transforms worthless land

into a tangible asset and creates new values where none existed before.

The financing of western irrigation projects has always interested the money markets. Early undertakings were successful from the start because the idea was new, the projects were few, and the engineering of the simplest. Within the past few years the allurements of other investment and the plethora of irrigation schemes has made their financing a matter of increasing difficulty. This difficulty has been augmented by the failure of settlers to carry out their part of the work, largely because of ignorance of the conditions with which they must contend.

The U. S. Reclamation Service has already taken active steps to educate settlers, actual and prospective, as to approved methods and possible markets. Private companies, especially those controlling large projects, should follow this example. For in the end the character of the settler is the most vital factor in irrigation. A close study of conditions is the only way to arrive at a correct solution, whether the settler is a refugee from stricken Belgium or a tenement dweller from Chicago. Education is the key-note to successful irrigation.

While legislation represents a sincere effort to increase confidence and help the sale of bonds, the fact remains that the records of successful projects will sell far more bonds than will ever be accomplished by legislation.

The control of surges in high head pipes is of vital importance in the operation of water power plants. Surges disturb the turbine governors and may even burst the pipes by water hammer. This vibratory motion is due to the sudden stoppage of a moving column of water, often weighing hundreds of tons.

For many years surge difficulties were met by an ample factor of safety in designing the pipe and by providing outlets which could not be closed within a certain pre-determined time. Nozzle deflectors and waste weirs were also used to take care of the fluctuations. During recent years as the conduits have become longer the problem has become more complex, usually being solved by installing a stand-pipe as close to the point of sudden stoppage as the conditions of the installation will permit.

About four years ago Prof. W. F. Durand of Stanford University worked out a method which permitted direct calculation of the design of a surge chamber which would meet any pre-determined program of water time-acceleration in the conduit. His theory was applied to practice in the design of one of the power plants of the Los Angeles aqueduct, a funnel-shaped pipe being used for the surge tank instead of the usual cylindrical form. At that time his work was acknowledged to be a long step forward in the rationalization of the hydraulic art, which has long suffered from too little theory.

Among the most notable contributions to hydraulic literature since then are two papers which are to be presented at the December meeting of the American Society of Civil Engineers. One of these, "The Differential Surge Tank" by R. D. Johnson, gives a

rigid mathematical treatment of the action which takes place in a pipe line and demonstrates that the differential surge tank gives better relief than the simple stand-pipe, a differential surge tank consisting of "a stand-pipe of about the same diameter as the conduit, freely connected to it, and a storage tank of larger dimensions, surrounding the stand-pipe and connected to the conduit by a properly restricted passage.

The other is a more general paper on "Penstock and Surge Tank Problems" by M. W. Warren, which derives mathematical formulas from the fundamental principles of hydraulics and applies them to the elimination of water-hammer and surges as well as the design of the most economical penstock size.

These studies represent another stride in the effort to raise hydraulic engineering from the plane of an art to that of a science between which is today but little difference in meaning since the distinction was first drawn: "artes," what one can do, "scientia," what one knows. The laws which govern the theory or water flow are less clearly defined than those in almost any branch of engineering. Steinmetz, for example, has worked out the theory of electrical surges so completely that actual results can be accurately predicted from the equations. Having now passed through the period of deductive development, "its facts being reproducible in the mind without constant recourse to observation," hydraulics is ready for its formal development, whereby facts are systematized so as to be reached and pictured with the least intellectual effort.

The electric railway companies have just adopted a code of principles which might well be followed by the power companies. The creed adopted at the Atlantic City convention of the American Electric Railway Association last month gives voice to the ideals of many of the leaders in the electric power industry. It applies with equal force and justice to all public utilities and may be interpreted with profit if read by replacing the specific term "electric railway," by the general term "public utility."

Service to the public is the first duty defined in the code, safety the first essential, and rates the basis upon which both must be built. A similar trio, initiative, economy and efficiency, result from private ownership, regulated by a state commission having control over the future but not past issues of securities. The code objects to short-term franchises, asks protection against excessive labor demands and favors the holding company. The principle is established that all methods of valuation should have due consideration in determining rates. Finally, full and frank publicity is advocated as the best policy at all times.

This brief summary of the railway code of principles is thus seen to be an excellent guide to the ethics of public utilities in general. There is a need for such definite formulation of ideas for the education not only of the public but also of the utility.

The key-note of efficiency is first to set a standard and then live up to it. The railways have set a standard which will gain and retain public confidence if it is lived up to. All other utilities should do likewise.

Surge Control

Public Utility Ethics

PERSONALS

John H. Lewis has been re-elected state engineer for Oregon.

J. J. O'Brien, associated with the H. M. Byllesby Company of Chicago, Ill., is at San Francisco.

E. D. O'Brien, assistant superintendent of public utilities, Seattle, is spending six weeks in the East.

Guy W. Talbot, president of the Pacific Power & Light Company at Portland, is at San Francisco.

H. H. Trowbridge, attorney with the Southern California Edison Company of Los Angeles, is at San Francisco.

R. E. Frickey, superintendent of Northern California Power Company, is a recent visitor at San Francisco.

Frank Dabney, assistant treasurer, Puget Sound Traction, Light & Power Company, is seriously ill at his home in Seattle.

Henry Lardner, vice president J. G. White Engineering Corporation, will return to San Francisco from an Eastern trip Monday.

M. E. Quinn, of the Marine Electric Company at San Francisco, was recently operated on for appendicitis and is doing nicely.

E. A. Quinn, general superintendent San Joaquin Light and Power Company of Fresno, was a recent business visitor at San Francisco.

W. L. Overman, Pacific Coast representative Hughes Electric Company, has returned to Seattle after spending a few weeks at San Francisco.

F. C. Stewart, formerly division superintendent Nevada-California Power Company, is now chief inspector for the Nevada Valleys Power Company.

H. F. Yost, representative Electric Railway and Manufacturers' Supply Company of San Francisco, is traveling throughout the northern part of California.

Geo. Drake Smith, agency supervisor of the General Vehicle Company, has been in Salt Lake City during the past week making a study of the electrical vehicle situation in Utah.

A. W. Woodville, manager of the supply department of the Westinghouse Electric and Manufacturing Company, Seattle, is confined to his home with a severe fracture of his right foot.

J. H. Jamieson, until recently connected with the Spokane office of the Westinghouse Electric & Manufacturing Company, is now in charge of the retail supply department of the Seattle office.

W. H. Griswold, formerly with the Seattle branch of the Stone & Webster Construction Company, has resigned to take a position as engineer with the Coast Culvert & Flume Company, Portland.

H. H. Cudmore, director Mazda bureau of the General Electric Company, has returned to San Francisco from a trip East, where he attended the annual congress of the Jovian Order at St. Louis.

F. C. Herrmann has resigned as chief engineer of the Spring Valley Water Company at San Francisco to engage in private practice, specializing in water supply, irrigation, drainage, sanitation and valuation engineering.

W. S. Heger, Western director Busch-Sulzer Bros. Diesel Engine Company of St. Louis, returned recently from an extended trip throughout the Northwest, and reports that business conditions in that territory are most encouraging.

H. V. Wilkinson is now in charge of the industrial and power department of the Seattle office of the Westinghouse Electric & Manufacturing Company. Mr. Wilkinson was formerly in charge of the Tacoma office of the same company.



Alton W. Leonard, who has just been appointed president of the Puget Sound Traction, Light & Power Company, with headquarters in Seattle, to succeed the late Jacob Furth, was born in Maine, forty-one years ago. At twenty-two he entered the service of Stone & Webster as a bookkeeper in the Edison Light Company at Brocton, Mass. Seven years later he was occupying the post of manager of the same concern. After making good in Brocton, Leonard was placed in charge of the Stone & Webster Companies in Hough-

ton, Mich., and four years later was made manager of the Minneapolis General Electric Company. This was followed by his selection as vice-president of the same corporation and later as district manager of all the Stone & Webster interests for the middle west. In October, 1912, Mr. Leonard was chosen as vice-president and general manager of the Puget Sound Traction, Light & Power Company. His appointment to fill the position made vacant by the death of Mr. Furth became effective November 1st.

W. H. McGrath has been appointed manager of the Puget Sound Traction, Light & Power Company at Seattle, Wash., succeeding to the duties of A. W. Leonard, newly-elected president of the company, whose assistant Mr. McGrath has been.

F. S. Balyeat has entered upon his duties as chief correspondent of the Seattle office of the Westinghouse Electric & Manufacturing Company. Before coming to Seattle, Mr. Balyeat was connected with the Pittsburg works of the Westinghouse corporation.

D. W. Henderson, superintendent of transportation, Puget Sound Traction, Light & Power Company, Seattle, and **E. A. Batwell**, publicity agent for the company, have returned from Atlantic City, N. J., where they attended the convention of American Electric Railway Association.

F. J. Blaschke, in charge of the publicity department Mazda bureau of the General Electric Company, has returned to San Francisco from Cleveland, where he was married on November 5 to Miss Nellie I. Joseph. Mr. and Mrs. Blaschke will make their home in Oakland, California.

James R. Strong, of the Tucker Electrical Construction Company, New York, and a director of the Society for Electrical Development, arrived on the Coast during the week and is spending a few days in San Francisco, before returning home via Los Angeles and the Grand Canyon.

T. J. Pace, manager arc light department of the Westinghouse Electric and Manufacturing Company of Pittsburg, Pa., with **J. G. Miles**, manager supply department, left San Francisco for Los Angeles after spending a few days at San Francisco. They are on their annual tour of inspection.

S. T. Whitaker, local manager of the Utah Light & Traction Company at Ogden, Utah has returned from the Pacific Coast where he had gone to undergo a special operation. He is recovering rapidly from its effects and expects to soon find himself in much better health than he has been for the past several years.

C. B. Hawley, general manager of the Inter-Mountain Electric Company of Salt Lake City, has spent the past week in Boise, Idaho, where he has been winding up the affairs of his company's Boise branch. Owing to the financial difficulties which the public utility companies there have been experiencing, the new work in sight does not warrant the maintenance of a branch there now.

T. E. Collins, formerly manager of the Detail and Supply Division in the local office of the Westinghouse Electrical and Manufacturing Co., is now associated with **Jos. S.**

Thompson in the Pacific Electric Manufacturing Co., and in future will promote the sales of the products of this company in new fields as well as distribute on the Pacific Coast the products of certain Eastern manufacturers with whom connections have been made.

Geo. B. Muldaur, field representative of the Society for Electrical Development, is making a tour of the west in the interests of that organization, his itinerary including the principal cities of the intermountain and west coast territory, including Denver, Salt Lake City, Spokane, Seattle, Portland, San Francisco, and Los Angeles. On Thursday, October 29th he talked before the Colorado Electric Club, at Denver, and on Thursday, November 5th before the Utah Electric Club at Salt Lake City.

OBITUARY.

Paul Seiler, a pioneer electrician of the Pacific Coast, died at San Francisco, Saturday, November 7, 1914, after a long illness. He was prominent in the electrical appliance business in San Francisco for forty years. He procured over thirty patents. They included an improved key for transmitting wireless messages, block signals for railroads and semaphore signals for single railroad tracks. Seiler was born in Berlin in 1845. In 1879 he organized the American Speaking Telephone Company in San Francisco, installing 2500 telephones. He was one of the organizers and directors of the Mechanics' Bank, a director of the German Hospital, for twelve years president of the Pierce Hardware Company of Oakland, and owner of the Paul Seiler Electrical Works.

MEETING NOTICES.

Oregon Society of Engineers.

The regular Monday luncheon of the Oregon Society of Engineers was held on November 2d at the Hotel Bensen, Portland, Oregon, and the speaker of the day was Mr. W. W. Cotton, counsel O-W. R. & N. Co., his subject being a brief review of the measures on the ballot which were voted on the following day. The chairman of the day was Mr. D. C. Henny, consulting engineer, and past president of the society.

Portland N. A. S. E.

On November 5th in the Imperial Hotel Oregon No. 1 of the National Association of Stationary Engineers, celebrated its nineteenth birthday and the thirty-second anniversary of the formation of the order. W. I. Barley, president of Oregon No. 1, delivered a brief address of welcome to the members and especially the out-of-town visitors, and introduced O. I. Bennett, a past president, as toastmaster. Among those responding to toasts and speaking on subjects of interests to the members of the association, were President W. I. Barley, State Deputy Charles Cooper, O. B. Coldwell, superintendent of the Portland Railway, Light & Power Company; G. W. Littler, president of the Oregon Electrical Contractors' Association; H. E. Judge, manager of the Valvoline Oil Company; J. D. Asher, ex-vice-president of the National Association; C. B. Paddock, manager Hartford Boiler Inspection Association; R. W. Simeral and William Bennett, both of Salem No. 2; G. B. Fields and W. H. Catrall, both of Astoria No. 3; C. P. Osborne, operating engineer Portland Railway, Light & Power Company; Chief Engineer Waite of the Northwestern Electric Company, and Mr. Kelly, of the Standard Oil.

Los Angeles Section A. S. M. E.

On October 28th the American Society of Mechanical Engineers, Los Angeles Section, held a dinner and meeting at the Clark Hotel in Los Angeles. In this meeting a letter was read from the parent Society authorizing the formation of a regular section of the Society in Los Angeles. The local membership have been holding meetings under the temporary organization for the purpose of seeing whether or not it

would be feasible to maintain a section in Los Angeles. Their experience with the temporary organization over about one year's time shows that there is no question but that such a section can hold interesting and profitable meetings and that the local membership are all anxious to make it a success. George A. Damon read a paper on the local transportation problem, which was thoroughly discussed by F. C. Finkle and C. K. Mohler. Professor W. H. Adams of Throop College of Technology is chairman of the Section, and Ford W. Harris, 1029 Higgins Building, Los Angeles, California, is secretary. It is proposed to hold quarterly meetings and the executive committee has already planned important meetings for the coming year.

International Engineering Congress, 1915.

A report having recently been circulated to the effect that the International Engineering Congress was to be abandoned, we desire to state that this is not correct, but that the Congress will be held in San Francisco as scheduled, from September 20th to 25th, 1915.

In view of the conditions now prevailing in Europe, the governing bodies of the five National Societies under whose auspices the Congress is to be held, have recently given careful consideration to the feasibility of holding the Congress and to the probability of its success, with the result that each body has unanimously confirmed its original pledge to support the Congress. The Committee of Management is actively proceeding with arrangements, which are now well advanced, for meetings on the scheduled dates and for the publications of the transactions.

The Committee of Management is in receipt of a sufficient number of communications from various foreign countries throughout the world, including those located within the war zone, to indicate that a large majority of the papers originally requested for presentation at the sessions of the Congress and publication in its transactions will be handed in on time, and that the Congress will be truly international in character.

A detailed circular of information regarding the publications of the Congress has been prepared by the committee, and will be sent upon application to the secretary, in the Foxcroft Building, San Francisco, California.

W. F. DURAND, Chairman.

W. A. CATTELL, Secretary.

Jovian Electrical League of Southern California.

Interest in the Jovian League, at Los Angeles continues at a high plane. On October 21st Edison day was celebrated with an attendance of 200; on October 29 United States Senator John D. Weeks gave a patriotic address on Progress, and J. D. Paulding spoke on the Eight Hour Law, which has since been defeated. Chairman J. Harry Pieper has announced the following committees:

Program Committee.

G. B. McLean, Pacific Light & Power Co., Chairman.
James F. Regan, Edison Storage Battery Co.
L. E. Barrow, Western Electric Co.

Membership Committee.

W. J. Gracey, Pacific Light & Power Co.
W. W. Coit, General Electric Co.
D. K. Harris, Southern California Electric Co.
H. W. Harrison, Commercial Electric Garage.
E. R. Northmore, Los Angeles Gas & Electric Co.
A. G. Yono, Southern California Edison Co.
K. E. Van Kuran, Westinghouse Electric & Mfg. Co.
J. E. McDonald, Joint Pole Committee.
A. G. Drake, Woodill Hulse Electric Co.
Hal Miller, Pasadena.
J. L. Gray, Southern California Edison Co.
F. J. Airey, Pacific States Electric Co.

Finance Committee.

Ira J. Francis, John A. Roehling's Sons Co., Chairman.
C. S. Carter, Pacific States Electric Co.
C. B. Hall, Illinois Electric Co.
H. F. Anderson, Pacific Telephone & Telegraph Co.
E. L. Lewis, Los Angeles R. R. Co.
M. W. Graham, Holabird Reynolds Co.
A. R. Fierce, Electric Corporation.
J. L. Kline, Western Lighting & Fixture Co.
A. B. Day, Los Angeles Gas & Electric Co.
K. E. Van Kuran, Westinghouse Electric & Mfg. Co.
G. B. McLean, Pacific Light & Power Co.

J. A. Rendler, Southern California Electric Co.
A. E. Morphy, Southern California Edison Co.
Harry West, F. P. Newberry Electric Co.
J. O. Case, General Electric Co.
T. E. Burger, Western Electric Co.

Civic Committee.

George A. Damon, 832 San Fernando Bldg., Chairman.
C. S. Walton, Southern California Edison Co.
E. L. Lewis, Los Angeles R. R. Co.
R. H. Manahan, City of Los Angeles.
J. G. Pomeroy, 833 San Fernando Bldg.

Press Committee.

G. E. Abrogast, F. P. Newberry Electric Co., Chairman.
C. F. Baker, Electric Lighting Supply Co.
C. C. Young, Illinois Electric Co.
C. G. Pyle, Standard Underground Cable Co.

The luncheon on November 4 was attended by over 100 Jovians and their friends. Statesman Pieper announced the appointment of a "dues are due" committee, composed of A. B. Day and K. E. Van Kuran, and the following reception committees: For November, Karl Johnson and R. W. Murphy; for December, H. C. McCutcheon and E. L. Lewis. In order to further stimulate sociability and a closer acquaintanceship among the members, he inaugurated three-minute talks by three members on three other members of the League. It is the duty of the talkers to find out all the personal characteristics of those about whom they have to talk, and much wholesome fun is expected to be derived from these biographical effusions. The talks at the next luncheon will be as follows: J. E. Barker on D. K. Harris and the Southern California Electric Co.; C. B. Hall on J. E. Tucker and the Greenwood Advertising Co.; G. F. Kirkpatrick on J. L. Kline and the Western Light & Fixture Co.

The chairman of the day was F. J. Airey, who introduced the well-known Ad Club Trio, who rendered a splendid vocal program, accompanying themselves by mandolin, piano-guitar and ukelele. A very interesting address on "The San Diego Exposition" was delivered by F. E. Davis of the Division of Exhibits of the Panama-California Exposition.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision authorizing the Southern Sierras Power Company to issue four promissory notes in the sum of \$5000 each to E. S. Moulton, trustee. The Nevada-California Power Company, which is heavily interested in the Southern Sierras Power Company is given authority to guarantee payment of both principal and interest of the notes.

The Coast Counties Gas & Electric Company has filed an application with the commission requesting authority to issue \$50,000 par value of 6 per cent debentures at not less than 90 and accrued interest. The company proposes to use the proceeds from the sale of these debentures for the purpose of reimbursing itself for moneys previously expended from income.

The commission has rendered a decision authorizing the Los Angeles & San Diego Beach Railway Company of San Diego to issue three promissory notes totaling \$32,000 and bearing interest at not to exceed 7 per cent per annum.

The commission has issued an order extending the time in which the California Telephone & Light Company may issue \$100,000 of bonds and \$50,000 of preferred stock to December 1, 1915.

NEWS OF OREGON RAILROAD COMMISSION.

Stating that it is convinced, after a preliminary investigation of the rates and regulations of the Pacific Telephone & Telegraph Company, that sufficient grounds exist to warrant a formal investigation to determine their reasonableness and justness, the commission has notified the company that it will hold a hearing on the subject on November 27. The hearing will be wide in its scope. It will be a probe of all the company's rates and regulations. The company for a number of months has anticipated the investigation, and has had experts at work in the state obtaining a val-

uation of the company's properties and making investigations of its rates, with the view to justifying itself at the hearing.

Water rates in Dallas have been reduced almost 20 per cent by an order of the commission in the case of the city of Dallas against H. V. Gates. The city complained that the rates charged by Mr. Gates, who conducts the water system, were excessive. Mr. Gates, in his answer, asserted that the plant was owned by the city and as he was only the lessee the commission had no jurisdiction in the case. The commission, however, finds that Mr. Gates is owner of the plant.

The commission has announced that it will not hear the application of the Corvallis Independent Telephone Company for permission to increase its rates and also for permission for the Pacific Telephone & Telegraph Company to increase its rates in Corvallis. The companies formerly engaged in a rate cutting contest, and now the independent company alleges rates are too low. In making the decision the commission said it would be impossible for it to determine the proper rates of the Pacific Telephone & Telegraph Company under the application, and that besides it was making a general investigation of the business of that company. The independent company was informed the commission would hear an independent application for permission to increase its rates and was given 10 days in which to make it.

NEWS OF IDAHO PUBLIC UTILITIES COMMISSION.

The commission has issued an order fixing rates for the cities of Moscow, Genesee, Troy, and St. Maries now served by the Washington Water Power Company and has cited the company to show cause why the rates should not be put in force. The Washington Water Power Company supplies service to a large part of the northern part of the State and a number of complaints have been made to the commission that unfair rates were being charged. An investigation of the rates charged by the company has been postponed for the reason that there has been a suit pending in the courts regarding the right of certain complainants against the power company to having free access to the company's books. This suit was decided recently by the Supreme Court, which handed down a decision to the effect that not all the books, but only those which the commission decided were necessary to the prosecution, could be made accessible to the complaining company. By the order just issued the investigation into the power rates in the north is ordered, and since the probe is certain to be slow work, a supplementary table of rates is given, to apply until the commission rules otherwise or until after the investigation is concluded and the hearing had.

For the first eight kilowatt hours or less per month the rate is fixed at one dollar. For the next 12 hours or less the rate is to be 11c, for the following 10 hours or less, 10c and for all over 30 hours, 8c. These rates are to apply to 72 kilowatt hours, the kilowatt of connected load, and for all over that amount there is to be a charge of five cents the kilowatt hour. It is explained that the connected load shall include the total wattage of lamps. Empty sockets shall be taken at 25 watts each. Unless the company files this schedule of rates before November 19th the commission orders that it must show cause on December 12th why the rates should not be established.

The schedule of rates prepared by the Plummer Light & Power Company which has just completed its plant has been filed with the public utilities commission for its approval. The charges range from 13 to 16c per kilowatt hour with a minimum charge of \$2.00 per month and on a flat rate basis, from 2½c to 2c per candle power per month with a minimum of \$1 per month. The municipal rate is stated as 1 1-3c per candle power per month.



NEWS NOTES



INCORPORATIONS.

LOS ANGELES, CAL.—Tahoe Electric Water Company, \$100,000, subscribed \$5, by M. Jeffrey, Mrs. E. and G. R. Brown, W. Few, and F. J. Toniger.

SEATTLE, WASH.—The American Nitrogen Produce Co. Seattle, has been incorporated with a capitalization of \$750,000, by Frank H. Osgood, B. Thomas, Eli Janson, A. O. Loe and Ivar Johnson. Peters & Powell, New York Block, Seattle, are attorneys.

TACOMA, WASH.—The Electro Chemical Co. has been incorporated with a capital of \$26,000, by Alfred E. Goldsmith, Albert D. Eshelman, James H. Linton, Edward D. Goldsmith and Wallace C. Eshelman. Hugo Metzler, 401 Bernice Building, Tacoma, is attorney.

FINANCIAL.

SAN FRANCISCO, CAL.—Of the \$200,000 assessment levied by the Northern California Power Company, \$130,000 has been paid, and it is understood that the remainder will be paid before sale day.

NEWPORT, CAL.—An ordinance amending Ordinance No. 102, has been passed providing for the issuance and sale of bonds in the sum of \$20,000 for the acquisition and construction of an electric street lighting system.

TWIN FALLS, IDAHO.—The Great Shoshone & Twin Falls Water Power Company, with its power source Shoshone Falls, November 2d went into the hands of a receiver, due to the prevailing conditions in the money market. Judge Dietrich in the United States Court, on petition of James R. Towle, a resident of the Twin Falls country, appointed William T. Wallace receiver of the company and made an order that the business of the company should proceed as heretofore, as to administration. The petition sets up that the company has no bonded indebtedness but had financed itself with short time loans. These notes are now due in the east, with no funds to meet them and no opportunity for extension or renewal. It is stated that the company is to be refinanced under the receivership. The Great Shoshone Company supplies a large territory, including the Twin Falls tract.

OAKLAND, CAL.—A complete plan of reorganization for the People's Water Company has been submitted to the seven protective committees representing the different classes of security holders by the refunding committee. The plan contemplates the organization of a new company to take over the assets of the Peoples Water Company and pay off the current obligations, refund the secured indebtedness and carry on the business. An issue of \$12,500,000 30 year first mortgage 5 per cent bonds and an issue of \$7,935,000 of capital stock is provided for in the plan. Holders of the Peoples Water Company second mortgage 5 per cent bonds will be offered common stock on the basis of 10½ shares for each \$1000 bond. The proposed directorate of the new company is as follows: Henry E. Bothin, H. C. Capwell, W. Creed, John S. Drum, J. Y. Eccleston, E. A. Heron, Arthur G. Tasheira, F. W. Van Sicklen and Frank M. Wilson. The bondholders and noteholders are asked to deposit their securities with the Savings Union Bank & Trust Company at once and sign the reorganization plan, subject to the approval of the bondholders' committees.

ILLUMINATION.

SAN GABRIEL, CAL.—Bids will be received up to November 24th for a 40 year franchise to operate a system of gas pipes and lines within this city.

GERALDINE, MONT.—Work has been started by W. L. Kemper of Great Falls, on the foundation of the building for the electric light and power plant.

SAN FRANCISCO, CAL.—The board of supervisors have made appropriations of \$6000 for conduits, wiring and switchboard for lighting the Civic Center plaza.

HOQUIAM, WASH.—The Burnett gas franchise ordinance was adopted by the city council. It is now ready to be voted upon by the electors at the regular city election in December.

SAN DIEGO, CAL.—The Howell Electrical Company submitted the lowest bid for installing an electric lighting system on the municipal pier, and it has been awarded the contract for \$1279.

LOS ANGELES, CAL.—Bids will be received by the board of supervisors of Los Angeles county up to December 7th for a franchise to maintain certain gas pipes in the county beginning at the intersection of Wardlow Road, near the city of Long Beach.

RIVERSIDE, CAL.—Upon the report of City Treasurer Gunsolus that the total assessment for the Seventh street ornamental lighting district, amounting to \$5,235.53, had been collected, advertisement for bids to be opened November 24, was ordered published.

PHOENIX, ARIZ.—In City Electrical Inspector Dodge's report to the city commission on the proposed installation of a municipal electric lighting plant he estimates the cost considerably below \$60,000. A system of street lights is also proposed in conjunction with the municipal plant.

BOISE, IDAHO.—City Engineer Stevenson is endeavoring to settle the points in controversy between the city of Boise and the Standard Engineering Company arising from the installation by this company of a four ampere luminous arc lamp ornamental post system of lighting for Boise.

TULARE, CAL.—Plans for an elaborate system of electroliers have been presented to the council by a committee from the Merchants' Association, and the city attorney was instructed to draw up a resolution of intention for carrying them out. The plans call for 50 lights in the business section of the city and the laying of about 8000 feet of conduit.

MARTINEZ, CAL.—Work has been started on the new gas plant of the Contra Costa Gas Company, which will be located at Pittsburg, and will supply gas to the towns of Martinez, Concord, Pittsburg and Antioch. S. Waldo Coleman is president of the company, which has already begun work on the gas pipe systems in the four towns.

SHOSHONE, IDAHO.—It is intended by the board of trustees of Shoshone to install the new nitrogen lights for street illumination, doing away with the present arc lights. There will be a light swinging over the center of every street crossing. The street lights are 100 candle power, with a number to be installed in the depot yard and crossings of twice that power.

FRESNO, CAL.—The trustees, under protest of the electrolier salesmen have voted to withdraw the original specifications. It is stipulated that four kinds of material must be named for the posts, two designs of lamp mentioned and four or more kinds of brands of conduits. The copper man, the iron man, the steel man and the concrete man will have no further opportunity to complain. The new specifications will be approved at the next meeting of the board and a new set of bids will be called for.

ASHLAND, ORE.—The city is up against the proposition of either declining further patronage in the way of light and power under prevailing conditions or else installing an auxiliary electric plant supplemental to the present municipal system, which is already carrying a peak load on all occasions, to say nothing of special emergencies. A proposition before the council provides for issuing bonds to the amount of \$32,000 to install this auxiliary plant, which it is planned to build about a mile below the present power house, the natural fall of the creek in that distance affording a duplication of power.

TRANSMISSION.

OAKLAND, CAL.—An ordinance has been passed to print appropriating the sum of \$1550 out of the general fund which to purchase underground cable for use of the electrical department.

PORT ANGELES, WASH.—The Olympic Power Company is installing a 500 k.v.a. synchronous condenser, which is direct connected to a synchronous booster, at its Bremerton, Wash., substation. This will regulate the voltage to both the Puget Sound Navy Yard and the Bremerton distribution lines.

SEATTLE, WASH.—The lighting department of the City of Seattle has received two complete sets of 60,000-volt Westinghouse oil switches for its two transmission lines. One set of these switches will be installed at the substation, Seventh and Yesler, and one at the generating station, Cedar Falls.

KLAMATH FALLS, ORE.—Electric lights for homesteaders and electricity for the reclamation of marsh lands and performing other work are some of the features of a project now being worked out by residents of the district along the west site of Upper Klamath Lake. The matter has been taken up with the California-Oregon Power Company.

ROCHESTER, NEV.—J. W. French of Riverside, Cal., is the main contractor who will construct the service line from Lahonton into Rochester for the Nevada-California Power Company, with F. A. Campbell of Bishop, Cal., sub-contractor. W. H. Leffingwell is the chief engineer. Thirty-five to forty men will be employed in extending the line. The cost of the work will approximate \$220,000.

ALAMEDA, CAL.—The electricity commission is advertising for bids for the enlargement and extension of the fire-alarm system of Alameda. The cost is to be defrayed from the surplus of the plant's earnings. The obsolete system in the garret of the city hall is to be eliminated and a new central station installed at the municipal electric light plant. Seven new fire alarm boxes are to be installed in the new residence districts.

BOISE, IDAHO.—The Idaho Power & Light Company has been successful in its legal fight with the Great Shoshone & Twin Falls Water Power Company for control of the power site rights along the Malad River, according to a decision that has been handed down by Judge Frank S. Dietrich of the Federal Court. The Idaho Power & Light Company built a flume across land owned by the Great Shoshone Company. The latter company averred that the right of way for the flume was valued at from \$100,000 to \$400,000. Judge Dietrich allowed \$5500 for the right of way.

SAN BERNARDINO, CAL.—Included in the proposed improvements to be made by the Holton Power Company is a transmission substation at El Centro to cost \$45,000, and a transmission line from El Centro to Seeley and Dixieland to cost \$12,078. Service connections in towns served are also to be increased in number, which will mean the extension of pole lines and increasing voltage of existant substations. Also included is the 125 mile, 55,000 volt power line from the connection with the Southern Sierras Power Company at Banning to connect with the Golton Power Company at El Centro, \$221,887; substation at Coachella, \$11,768, and distributing system at the same place, \$58,000.

BOISE, IDAHO.—The machinery for the installation of the Granite County Power Company at Maxville, Mont., has been shipped, and Walter Neal, consulting engineer in charge of erection of machinery, states that the entire power plant and mill equipment will be in operation by the first of the year. The power plant will generate a pressure of 6600 volts and will be transmitted to a distance of approximately six miles to the Royal Basin Mining & Milling Company's property. The power will be utilized in driving the grinding machinery and furnishing energy for use in the Field's flotation process in the milling plant recently completed at the mine. It is also the intention of the company to operate the mining equipment by electric power and to furnish several small towns near the power site with light and power. The line may eventually be extended to Drummond, Mont. The water of Flint and Boulder creeks will be utilized to operate the turbine at the generating station. It will be piped from the forebay, a distance of 2600 feet, and into a large surge tank, in order that changes in pressure due to the opening and closing of the gate of the turbine may be regulated. The electric equipment at the mill will represent the latest practice in motor drives, and no expense has been spared to make the entire plant modern in every particular. Lightning arresters will be installed to counteract the effects of lightning strokes, and surges on the power line and automatic switches will afford complete protection to all of the machinery, both at the power station and at the mill and mine. The site of the power plant is about one mile below the Maxville station, on a branch of the Northern Pacific to Phillipsburg, and a spur has been constructed by the railroad company to the power site for the more efficient handling of the machinery. At the mill the voltage will be stepped down from 6000 to 440 for use on the motors. The poles for the transmission line have all been cut from standing timber and in several cases the wires were strung on poles that happened to be in the direct line. The power line passes through a forest reserve on the way to the mine and crosses a heavily timbered region. The present motive power in use at the mine is steam, and in as much as the coal must be hauled several miles up the canyon the present cost of power is very high. Upon the installation of the electric equipment the cost will not exceed one-half cent per kilowatt hour, or a saving of practically 80 per cent in power costs. The complete power plant equipment has been manufactured at Milwaukee, Wis., by the Allis-Chalmers Company.

TRANSPORTATION.

STOCKTON, CAL.—The application of the Stockton Terminal & Eastern Railroad for a franchise over Miner avenue from Union to American street, and for trackage of the north side of the water front, has been taken under advisement.

MISSOULA, MONT.—The Missoula Electric Railway Company will be asked to extend the East Side line to the upper end of Parkside addition on Rattlesnake creek, a distance of three-fourths of a mile. B. A. Van Wormer, Geo. Baumgardner and Geo. Duncan, committee appointed by Mt. Jumbo Civic League to submit the question to officials of the road.

SACRAMENTO, CAL.—The city commission has directed City Attorney Yell to take action to forfeit the franchises of the Central California Traction Company and the Vallejo & Northern, a subsidiary of the Northern Electric, who operate interurban cars in this city. The city's move was the result of a long period of delay on the part of the traction company in improving Eighth street, L to M. The Central California Traction Company was requested over a year ago by Commissioner of Streets Burke to pave its tracks along Eighth street, but the company quibbled over the matter with the Northern Electric, each of the roads maintaining the other must do the improvement work. A short time ago the traction company told the commission it would not do the work.

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THE DEVELOPMENT OF OREGON'S WATER RESOURCES.

BY JOHN H. LEWIS.

STANDARDS AT SAN DIEGO.

BY L. M. KLAUBER.

INDUSTRIAL USES OF FUEL OIL.

BY F. B. DUNN.

THE OBLIGATION TO SERVE.

BY CHARLES P. CUTTEN.

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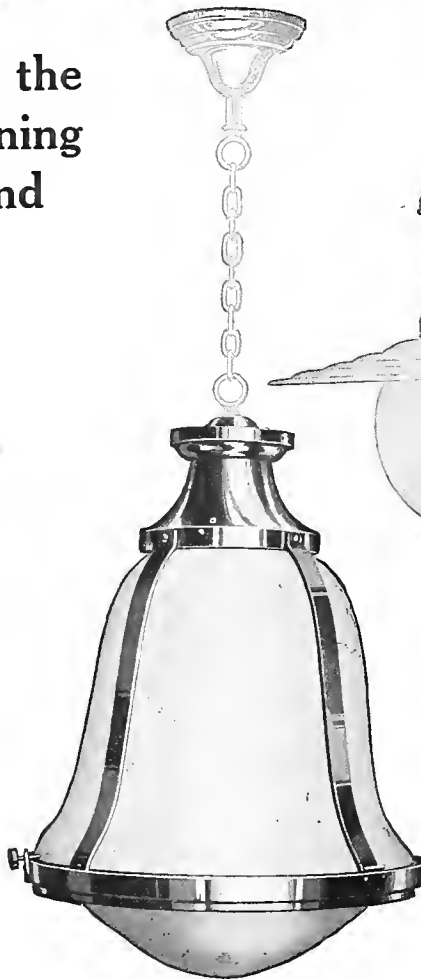
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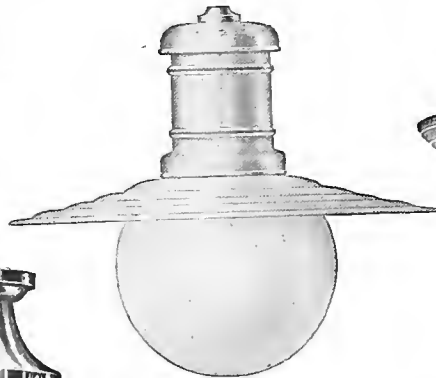
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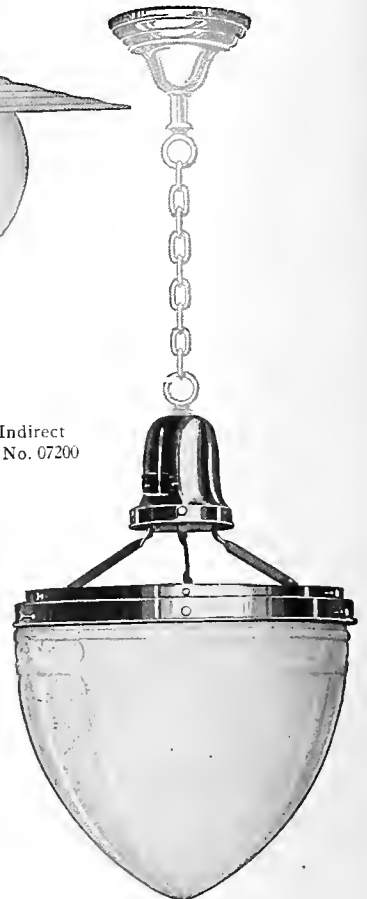


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VOLUME XXXIII

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THE DEVELOPMENT OF OREGON'S WATER RESOURCES

BY JOHN H. LEWIS.

(In a most comprehensive manner this paper outlines what has been done to protect Oregon's water resources and what is needed to develop them. Certain political matters which were settled at the November election have been omitted in adapting the paper from one read before the Six O'clock Club of Salem. The author has just been re-elected State Engineer for Oregon.—The Editor.)

In our state land policy, we locked the door after the horse was stolen. With our water resources, it is different. We locked the door before the thief appeared. But, unfortunately, we have kept the door tightly closed and still hold thousands of horses in enforced idleness while we go about our daily tasks

the ocean. Water was thus private property. Streams belonged to the owners of the banks. This is the doctrine desired by the water power interests, the great cattle companies and the land grant corporations, who, for speculative purposes, desire to hold both land and water without use.



The Three Sisters, Cascade Mountains, Oregon, Typical Snow-Clad Peaks Affording Ideal Conditions for Irrigation and Power Development.

in the same plodding way as those of other less fortunate countries. It will be my purpose to state briefly how the public happens to have this great resource still within its control, what steps have been taken to unlock the door for development, and the character of the key necessary to accomplish this purpose.

That this great resource has not been monopolized by the few for the oppression of the many is due to the fact that water has been declared by law to be property of the public and that beneficial use is generally accepted in Oregon as the basis for establishing and maintaining rights to the use of water.

We started out with the old common law doctrine of riparian rights which is to the effect that all streams must flow undiminished and unpolluted to

In the arid portions of Oregon, irrigation was found to be necessary for the production of crops and the courts were soon compelled to modify this strict doctrine so as to permit of a reasonable use of water on lands located at some distance from the stream. As these two doctrines are in direct conflict, the courts have held consistently that a litigant can claim either as a riparian owner or an appropriator, but he cannot do both. The courts soon become congested with litigation because of these conflicting theories and the small man was inevitably driven to the wall for lack of funds to defend his rights, while the great corporations divided the water between them.

After a four year campaign of education, Oregon's present water code was adopted by the legislature over

the protest of corporation lawyers and land speculators. It is based upon the theory of public ownership of streams and the right of the public to regulate all diversions under the police power of the state. It affords equal protection to all. This law is generally considered as a model for other states. It has now worked successfully for five years, and has so far withstood the attacks of the corporations before the courts. Recently the Federal Court held this water code to be constitutional, after the third attack by a California cattle corporation having lands in Harney Valley.

Unlocking the Door.

Oregon is generally conceded to have the most consistent and complete laws of any state in the union, looking to the development of her water resources. She is making water surveys so as to know defi-



Brokentop Mt., Whose Crater Glacier Supplies
Tumalo Irrigation Project.

nately how much water is available. A workable system is provided for ascertaining definitely how much of this is already appropriated for use, so that the amount of surplus water, if any, may be known. It is this surplus water which belongs to the people. Likewise we have provided a system for acquiring rights to unappropriated water. We are also making scientific studies as to the extent of water power and irrigation possibilities and preparing plans and estimates of cost for the construction of a number of large projects. The United States contributes dollar for dollar and co-operates in the carrying on of much of this work. The balance of the cost is offset largely by fees paid for services rendered.

Neither private or public funds can be invested with safety until we know the location and extent of surplus waters. The people have gone forward step by step following out a logical and conservative program with a view of unlocking the door for development, as soon as this can safely be done.

Owing to the complicated nature of water laws and water measurements, progress has been slow in securing the necessary laws and institutions.

We all know what an acre of land looks like, and how to acquire land titles, but with water and water titles it is different. We know that our valuable school lands were sold at a paltry figure without regard to the value of each tract, and the state school fund was in this manner robbed of millions of dollars by far sighted speculators. If an appropriation had been asked of the legislature to classify and appraise these lands for sale at their true value, these land speculators would doubtless have gone out before the people with a great cry for economy and defeated the measure until such time as their full purpose had been accomplished.

Accurate, reliable and full information accessible to the people is the key that is being used to unlock the door for development.

Difficulties in Irrigation.

Irrigation in the United States is not a poor man's proposition. Suffering and disaster is inevitable where the average man with a family attempts to establish himself on a raw tract of land without a bank account of several thousand dollars, under our present plan of full payment of the development cost within a few short years, coupled with high interest on deferred payments. The privations of pioneer life, and low margin of prospective profit have caused the rich to purchase only developed farms. Our present state and national policies for promoting irrigation have thus failed because the settler cannot make good. Where the settler cannot make a living for his family, he cannot pay for a water right.

Concerning our failure, Elwood Mead, head of the irrigation work in Australia, says: "The financial troubles of American irrigation development have their origin in two mistakes:

First—Construction of works outran the demand for irrigation by those able to pay.

Second—Failure to extend aid to men of small capital in overcoming initial obstacles."

Leading authorities in this country have recognized these difficulties, but the old cry of paternalism is raised when a practical remedy is suggested. We overlook the fact that the purchasing power of a dollar has greatly diminished since pioneer settlement days. Practically no progress has been made in clearing the logged-off lands of the Willamette Valley since this early era of cheap labor. We must have cheap labor or cheap money to make progress in developing Oregon. A return to cheap labor conditions is undesirable, but cheap capital can be made available if we have any confidence whatever in governmental machinery. We have made some notable advances in this direction with the successful construction of the Panama Canal, and the many projects of the U. S. Reclamation Service, without any suggestion whatever of graft. I believe it is safe

to go forward another step at this time and, especially in view of the great change which is taking place in world commerce.

Australia Solves Problem.

We are indebted to Australia for a successful large scale demonstration of state aid to settlers on irrigated lands. The same principle could doubtless be applied for the settlement of our logged-off lands. Under this system a poor man with energy and ability can go upon the land and make good from the start.

The first step in the Australian plan is to purchase the land at dry farm prices. After irrigation, this is sold at actual cost of land and water upon the following terms: Three per cent of the cost to be paid in cash, balance in 31½ years with interest at 4½ per cent. The small payment of 6 per cent annually will in such time pay both principal and interest. So satisfied is the government with the possibilities of this system of settlement, that it is now taking measures to further liberalize the terms by reducing the interest to 4 per cent and extending the payment to forty-one years. The state also builds houses for settlers, grades a part of their land, if desired, loans tools at the outset for a nominal fee, and charges the same to the land, giving a long time for repayment with low interest.

In addition to this, the state makes liberal loans to settlers, payable in 20 years at 5 per cent interest. These loans are based upon 60 per cent of the value of improvements which are made.

"Under these conditions, no man who will work need fail; and every man who longs for a home can secure it" according to Elwood Mead.

The Canadian Pacific Railway has adopted this plan of financing settlers, in the disposal of its vast holdings. So has New Zealand, and newspaper reports indicate that British Columbia is now considering the plan. After a few more of our best citizens have left for foreign countries, we may wake up to the fact that there is such a thing as competition in securing development.

If such a system could be adopted by Oregon, acting in co-operation with the United States, and utilizing its superior credit, the small payment of only four per cent annually could be made to pay both principal and interest on the original cost of development, provided payments are extended over a period of 50 years. Money at three per cent interest is used in this calculation. Development possibilities under such liberal plan of payment could be greatly stimulated, without at this time financing settlers if such plan seems objectionable.

Subduing the logged-off lands of western Oregon is perhaps a more formidable problem than irrigation in eastern Oregon, as the original acre cost in most cases will be higher. Large scale clearing operation with powerful machinery and perhaps some financial aid in the shape of low interest may be necessary before this problem is solved. Cities have learned to use their public credit for the benefit of its citizens. Why should not the state do likewise?

When men on developed farms with ample credit find it necessary to have some system of rural credits to supply cheap money for carrying on profitable farm-

ing, is it not high time that we devise some plan so as to afford cheap money for the man on the undeveloped farm where the initial outlay is much greater, and where title to the land is not secured until the development cost is fully paid? For lack of title these men, of whom Oregon is so much in need, cannot come within the rural credit scheme. Are we to deny them equal opportunities? Our vast public credit, like our land and water resources is lying dormant and unused.

Water Power Development.

The development of our vast water power resources, presents about the same difficulties as encountered in the development of our logged-off and arid lands. More water power is now developed than can be disposed of under present high rates. But with a radical reduction in rates, the market for electrical power seems almost unlimited. Cheap power can be used in the electric furnaces for the smelting of ores, in competition with coal heat, and the many new electro-chemical industries open up a vast field for development. The indirect benefits to be derived from this development, such as the canalization of our streams, the opening up of new industries, construction of electric railways, and the comforts to be derived through the increased use of electric power in the home and on the farm should justify the placing of water power development upon the same basis as we are now conducting irrigation development.

Notwithstanding the fact that we have in the Columbia River basin approximately one-third of all the undeveloped water power in the United States, and this, the property of the people, yet we are deriving no special benefit from this resource. Private capital has not, and apparently will not, make this power available for use at such rates as will permit those new industries demanding cheap power to live. Is it not time that we seriously consider some new plan which may result in putting this wasting power to use?

Perhaps the most extensive field for the utilization of this cheap water power is in the making of fertilizers. I am informed by experts, who are supposed to know, that Portland can capture the fertilizer trade of the world if she acts promptly. This trade amounts to \$500,000,000 annually. That for the United States alone is about \$150,000,000 annually, fifty per cent of which is with the cotton producing states of the south.

Three classes of material are necessary for the production of a balanced fertilizer, suitable for most ordinary purposes, namely: Phosphates, nitrates, and potash.

"The basis of all artificial fertilizers is superphosphate."

It has recently been discovered that this can be produced by heating phosphate rocks in the electric furnace. Large quantities of high grade phosphate rock are found in Idaho, Montana and Wyoming. These deposits are said to surpass those of Florida and the southern states. Ammonia and lime will be had as a by-product in making fertilizer in the electric furnace.

The world supply of nitrogen has heretofore come substantially from the natural deposits in Chile. We

have in Oregon enough nitrogen in the air over one square mile of the earth's surface to supply the world for 50 years, according to authority. This can be extracted in the electric furnace, if cheap power is available.

The world's supply of potash is extracted almost exclusively from the potassium salts coming from the mines of Strassfurt, Germany. In the kelp beds along the Oregon and Washington coast, we have a cheap and abundant supply of potash. This kelp can be harvested annually without injury to the plants, thus insuring a perpetual supply. Several simple methods of recovering this potash are known, one of which is an electrolytic process. These beds lie along the coast



Feed Canal for 23,000 Acre Tumalo Project, Built by State of Oregon at Cost of \$450,000.

within the three-mile limit and are apparently property of the state. Private capital has not been able to acquire title and exploit this resource, and the public has taken no steps to devise ways and means of harvesting and marketing this crop, which for years has been going to waste, while the American farmer is paying millions of dollars to the potash trust of Germany.

Cheap electrical power is the key to the development of this vast industry which will give profitable employment to thousands of men, and open the field to the establishment of innumerable by-product industries, the canalization of our streams, and the development of a world commerce, which would be of inestimable value in marketing our lumber, fruit, fish, dairy, and other products. All of the resources necessary to capture this enormous trade are located within or adjacent to the Columbia River basin.

If private capital could get possession of these resources, development would doubtless be under way, and prosperity abroad in the land. Or if the public could act promptly and intelligently, this prosperity would perhaps be greater and more equitably distributed.

Competition from the cheap water powers of Norway need not be feared as both the raw materials and markets are too far removed. Another attractive locality where enormous blocks of cheap water power can be had on tide water, is the Saguenay River in Ontario, Canada. Here American capitalists have pur-

chased extensive water power privileges and contemplate the construction of a 300,000 h.p. plant for the production of phosphoric acid fertilizer, using phosphate rock from Florida. (U. S. Daily Consular Reports, March 27, 1914.) Navigation to this plant is closed by ice five months in the year, and we need fear no competition from this source, unless we delay until the trade is firmly established in this foreign field, through the establishment of innumerable by-product plants.

The state and the United States are now co-operating in the investigation of a large water power project on the Columbia River near The Dalles with a view to outlining some plant for its construction. This is one of the largest water powers near tide water on the Pacific Coast, and investigations so far indicate no construction difficulties, which appear to be insurmountable. It is believed the final estimates of cost will be such that power can be sold in successful competition with any other project, so far known, and especially if public funds bearing low interest can be used in financing. It is the convenient rail and water transportation, mild winter weather, and the presence of necessary raw materials in the neighborhood, of this power, which make the project of such great commercial importance to the district.

Plan of Development.

How can this great development be brought about? It must be through the application of business principles along practical and conservative lines, whether undertaken by public or private capital.

The electrification of the railroads in the Willamette Valley was not commenced until every scheme and piece of apparatus was tried out on an experimental road in Southern California. The people cannot decide between public or private development without more definite and accurate information. Private capital will not exploit the field without tying up great bodies of natural resources, and then only when the prospective profits will be very large.

What is apparently needed for a solution of this problem is a demonstration power plant operating on a commercial scale, so that every phase of these varied enterprises can be tested out, perhaps in co-operation with private capital and the United States, and the information made accessible to the public. Such an experimental plant can and should be operated without cost to the taxpayer. This is the method which was adopted in Norway for encouraging the electric smelting of ores, utilizing the cheap water power of that country. It should work in Oregon. If private capital can be induced to enter the field, on reasonable terms, then further progress toward public construction should be suspended. In the construction of these large projects with public funds, there should be no thought of competition with private capital already invested in the field, but rather to do those things which such companies cannot do. The retailing of power to small consumers is an exceedingly complicated business compared with wholesale production. We will thus be dependent upon private capital for the real work of development, and any tendency of unfairness on the part of the public is liable to do injury.

ELECTRIC DISTRIBUTION

STANDARDS AT SAN DIEGO.

I—Miscellaneous.

BY L. M. KLAUBER.

[Continued.]

This section of the handbook contains several subjects which could not be classified otherwise, as follows:

I 10. Resuscitation Rules.

I 20. Company Telephones.

I 40. Phasing Out.

Three sheets of the handbook are occupied by the N. E. L. A. Rules for resuscitation in cases of

electrocution, asphyxiation, drowning, etc., which are here omitted because of their general accessibility. The list of company telephones is also omitted as being a matter of only local interest.

I 40. Phasing Out. These notes on phasing out are of assistance to line and wire men. Definite information on each specific case often saves time and trouble.

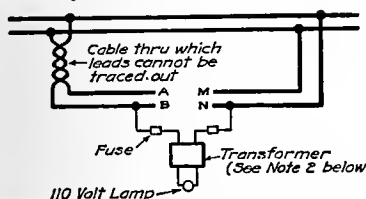
I 40.1. Connecting a Dead Three-Phase Line to a Live One.

Where a new three-phase line is connected to an old line no phase rotation precaution need be taken.

Where an old three-phase line, temporarily dead, is to be re-energized in such a way that it cannot be predetermined whether the phase rotation will be the same as it was under previous conditions, a man should be stationed at some small three-phase motor on the dead line where the previous direction of rotation is known. Close the motor switch. Then close the line switch momentarily, and communicate with the man at the motor. If the direction of rotation he correct the line may be permanently closed; if incorrect, reverse one phase. Large motors on the line will be protected by their low voltage releases.

I 40.2. Connecting Two Branches of Same Single-Phase Line When Leads Cannot Be Traced Out.

Connect a transformer between two leads as shown. If the lamp is dark the gap may be closed. If the lamp glows try AN.



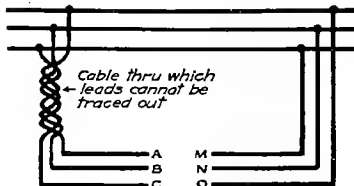
Note 1. Even if connecting BN shows a dark lamp it is safer to try AM also, before bridging both gaps, as there might be a break in B or N, and the dark lamp would not prove that they were from the same lead. It is also well to connect the transformer across AB first to see that the transformer, lamp and fuses are in operating order.

Note 2. For 11,000 or 2200 volt lines use 11,000 to 110 or 2200 to 110 volt transformers of the smallest size that can be conveniently obtained. For d.c. or low voltage a.c. circuits use banks of lamps consisting of 5-110 volt lamps in series for 550 volt circuits, 4-110 volt lamps in series for 440 volt circuits, etc. The lamps used must all be of the same wattage. In any case a voltmeter of the proper voltage may be used in the place of lamps.

Note 3. If one line has an excessive load and the other is lightly loaded, the lamp will glow lightly in all cases. In such a case remove the load while phasing out.

I 40.3. Connecting Two Branches of the Same Three-Phase Line When Leads Cannot Be Traced Out.

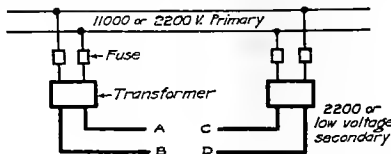
Follow procedure on Sheet I 40.2, trying A with M, N and O successively until corresponding lead is found.



Then try B with the two remaining; then C with the last one.

I 40.4. Connecting Two Single-Phase Lines From Separate Transformers.

In this case tests across AC and BD must be made simultaneously. Otherwise the procedure is the same as on Sheet I 40.2, connection being made



when both lamps are dark. When the two lines to be connected are 2200 volts the small testing transformers should be of the same ratio and capacity. Where the lines to be connected are secondary the lamps used should be the same size. It is understood that the transformers to be paralleled must be of the same ratio for successful operation.

Note. It is possible, but not advisable (except in the case of secondaries) to connect A to C and then test across BD. If the test is made in this way the voltmeter or lamps must have a range of twice the voltage of the circuit. This method has the advantage that only one voltmeter is required. If two leads are grounded at the transformers (as for instance A and C) this is equivalent to connecting A to C and the test should be across BD, using double range voltmeter or lamps. If this shows double voltage the ground on C should be transferred to D. In the case of 3-wire secondaries with grounded neutral test between outside leads with double voltage instrument.

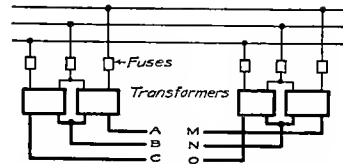
I 40.5. Connecting Two Three-Phase Lines From Separate Telephone Banks.

Take any pair of wires on one side and test with various pairs on the other side by the procedure shown on I 40.4 until proper lines are found. In order to miss no combinations try in the following order:

- A to M and B to N
- A to N and B to M
- A to M and B to O
- A to N and B to O
- A to O and B to M
- A to O and B to N

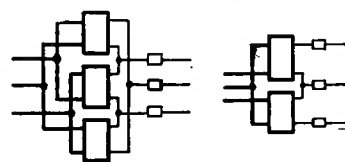
When the proper pairs have been determined, line C should test O.K.

[To be continued.]



with the remaining line of the other group. The same precautions should be taken as given in the note on I 40.4.

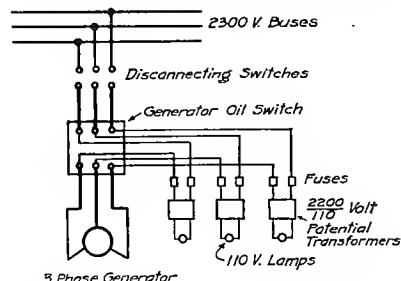
Occasionally cases may be found wherein the transformers of one bank have polarities other than standard. In this case, after the first two pairs of wires have been correctly phased, the third wire will not phase with that



remaining, but will show about 170 per cent normal voltage across the gap. If such a case be found, connect one bank of transformers as shown in the small drawing; or if a closed delta bank, as shown in larger drawing.

I 40.6. Phasing Out Three-Phase Generators.

In phasing out a new generator run it at approximately synchronous speed and bus voltage. With connections as shown above the lamps should all glow and become dark together. If they do not, reverse any pair of generator leads at the generator switch.



The lamps should then glow in unison and the new generator may now be synchronized in the usual manner. It is always advisable to run an extension cord from one of the sockets on the synchroscope, or if lamps are used for paralleling, from one of the synchronizing lamp sockets to a position near the test lamps, so as to be sure that these lamps also glow and darken in unison with the test lamps.

INDUSTRIAL USES OF FUEL OIL.

BY F. B. DUNN.

(Continued.)

Pumping Systems.

Many classes of pumping systems have been devised to handle the oil from the storage tank to the burners. As a rule they consist of two pumps mounted upon a bracket or base containing the oil heater which utilizes the exhaust steam from the pumps or live steam from the boilers, thus bringing the oil up to the required temperature. The pumps are set on a flat cast iron pan so arranged that they may be overhauled without allowing the oil or water to flow over the heater or fireroom, and deep enough to hold the oil contained in the pump cylinders. An oil relief valve is placed on the discharge line and fitted so as to allow any excess oil to return to the tank.

Oil strainers are either fitted in duplicate or the self cleaning type is used. An air tank is placed on the discharge line to take up the pulsation of the pump, thus insuring a steady pressure. The pressure is also regulated by means of a pump governor fitted on the steam line to the pumps and connected to the oil line.

By an arrangement of valves and fittings either pump may be used, the oil passing either through the

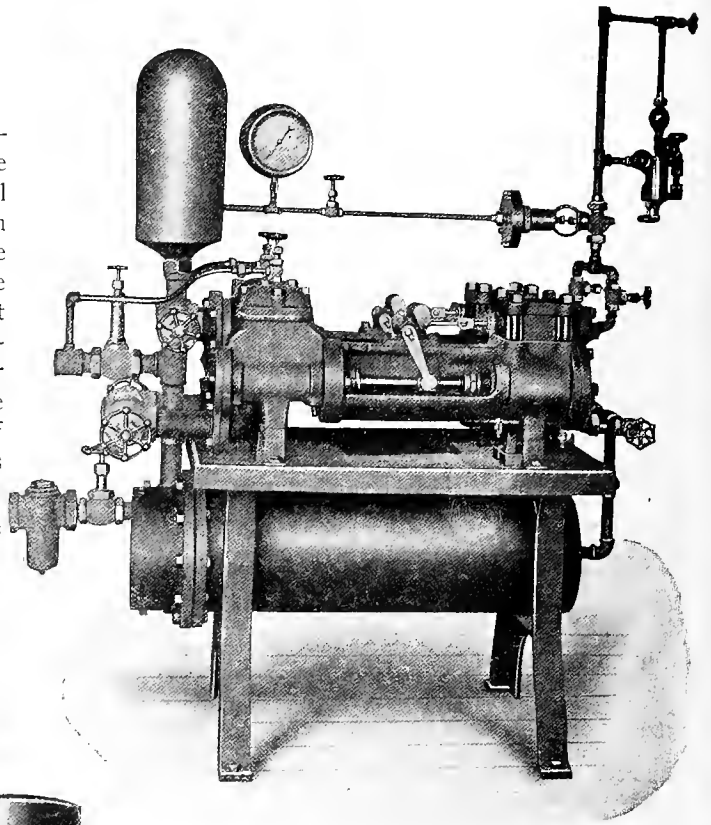


Fig. 9. Witt Oil Pumping System.

heaters or directly to the burners. Any gas formed in the oil chambers may be vented through proper valves and gages and provided to show the pressure and temperature.

Fig. 8 shows a complete and very compact fuel oil pumping system. Fig. 9 showing a less expensive installation.

Fig. 10 shows a pumping system and heater arrangement for a "mechanical" oil burner installation. Owing to the high pressures and temperatures used with mechanical systems, care must be taken to have all fittings of the best quality. Fig. 11 shows a low pressure heating system, used in kitchen ranges, hot water boilers, low pressure steam boilers, and hot air furnaces.

(To be continued.)

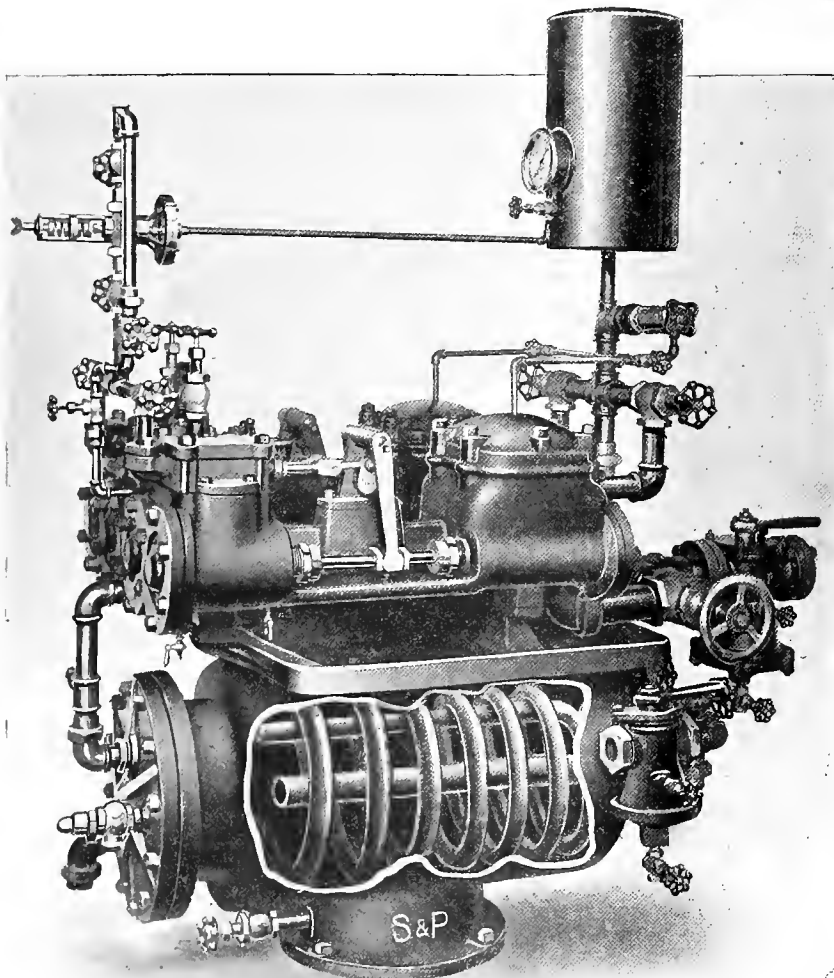


Fig. 8. S. & P. Fuel Oil Pumping System.

Electric propulsion of the collier Jupiter has proven so successful that Secretary Daniels has authorized the same plan for the new super-dreadnaught California, which will be built at the New York navy yard.

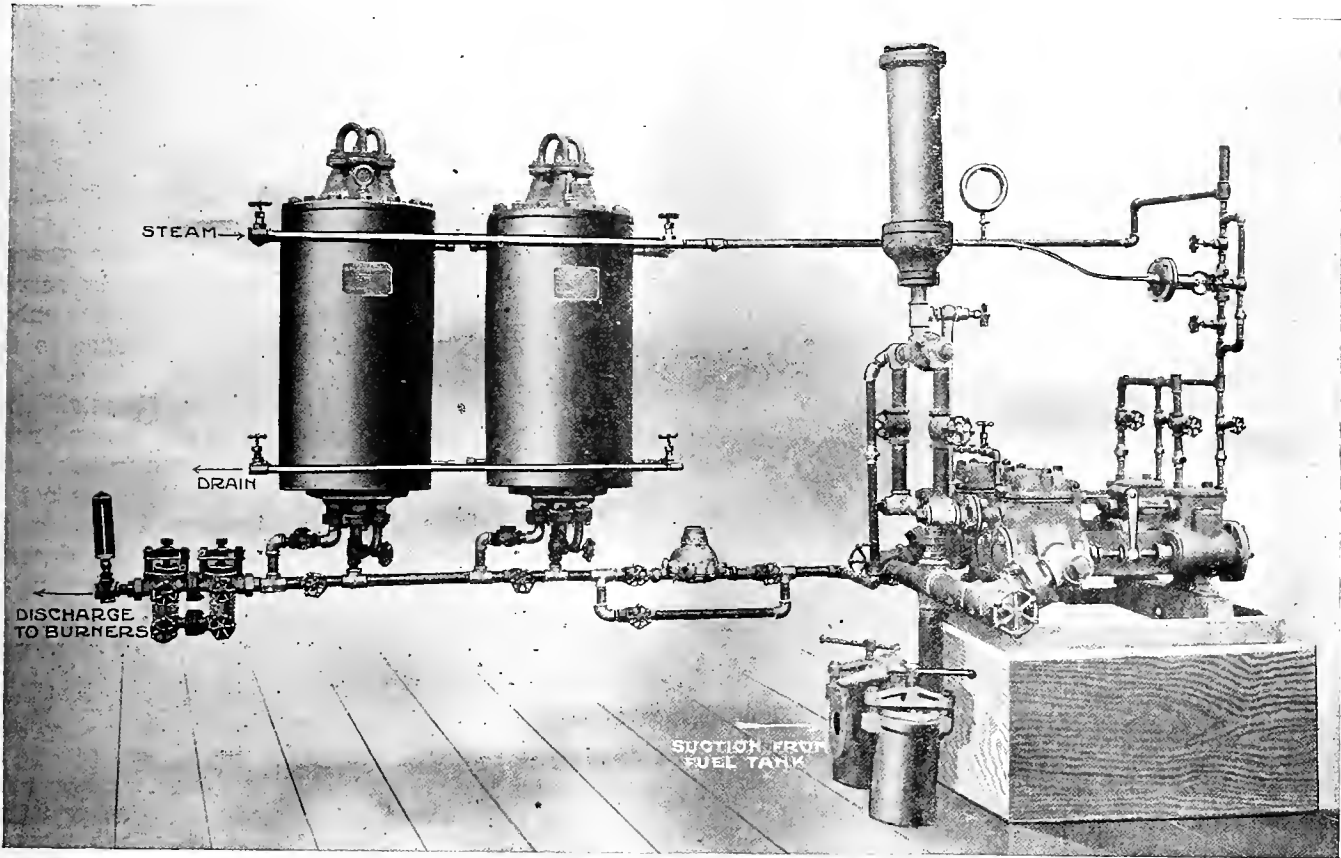
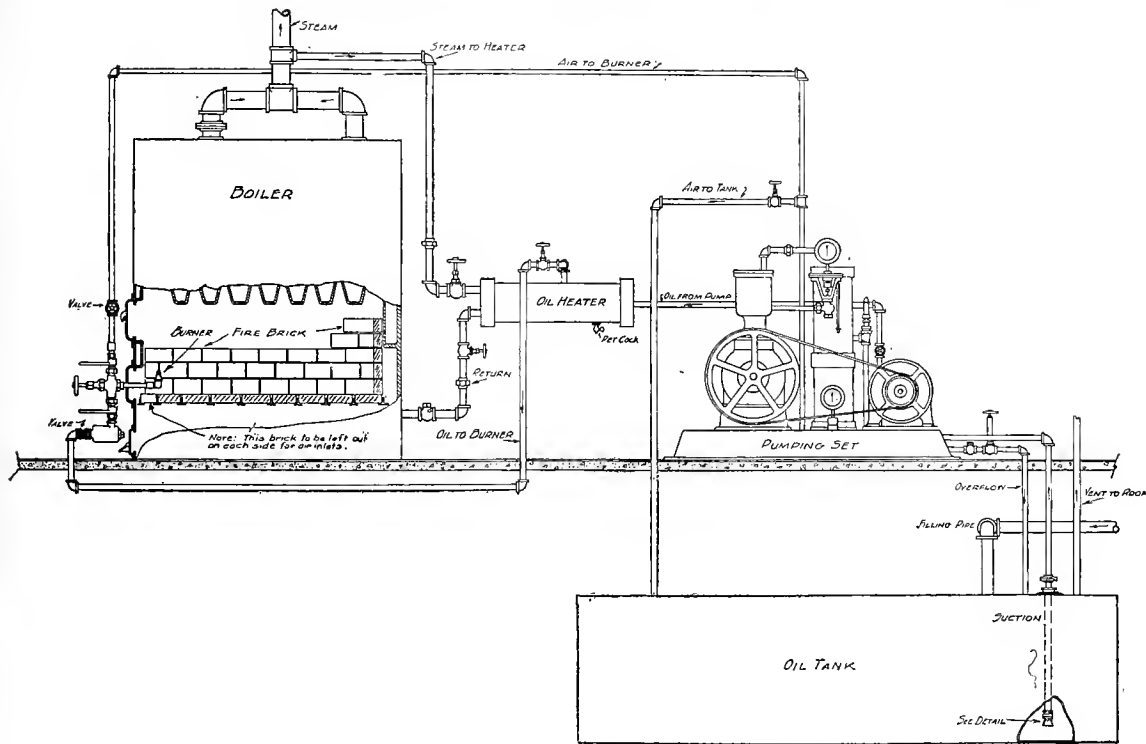


Fig. 10. Union Iron Works Oil Pumping System.



WILGUS AIR-OIL SYSTEM
FOR
CRUDE OIL
APPLICATION TO LOW PRESSURE
HEATING PLANTS
WILGUS MANUFACTURING CO.,
LOS ANGELES
CALIF.

Fig. 11. Wilgus Low Pressure Oil Pumping System.

THE OBLIGATION TO SERVE.

BY CHARLES P. CUTTEN.

(In this article the author contends that no unreasonable service extensions can be compelled, giving legal opinions to back up his contention. While this paper appertains particularly to gas, being condensed from a paper presented before the Pacific Coast Gas Association, the arguments are equally applicable to other forms of utilities.—The Editor.)

In general, the nature and extent of the obligation of a utility, whether it be a gas, an electric or a water company, depends on what that company has undertaken to do or what its public profession has been. Professor Bruce Wyman, in his work on Public Service Corporations, states the rule, as follows: "Public profession not only establishes public obligation but it largely determines the extent of the public duty. Just as people cannot be forced to serve unless they have made public profession, so they cannot be forced to serve beyond what their profession covers." For instance, a gas company going into business in an incorporated city does not by that act undertake to serve the people on the outskirts of the town but not within its boundaries. It may even limit its profession to serve to portions of the town. A company furnishes gas in one town, electricity in another, and water in a third, cannot be compelled to serve the first town with water or electricity, the second town with gas or water, or the third town with gas or electricity unless it has professed the particular service by some contract, franchise obligation or act of its own. In other words, the obligation to serve only extends to the sort of service in the particular territory which the utility has undertaken to supply.

But, having settled the primary question and determined just what territory the company has professed to serve and just what service it is furnishing, is the obligation to serve all in this territory with the commodity a fixed, determined and arbitrary obligation? My answer is no. Unless the demand for service is reasonable no extension can be compelled by any legislative or administrative body whether it be a commission or a municipal council. Justice Pitney of the Supreme Court of the United States when Vice-Chancellor of the Equity Court of New Jersey, illustrates the limitations imposed by a rule of reason on this obligation to serve. He says, in the case of *Public Service Corporation v. American Lighting Co.*, 57 Atl. 485-86, as follows:

Must not the demand for measured gas be reasonable? To illustrate: Suppose a person should rent for three summer months a vacant lot in Jersey City and facing on a street in which complainants had a gas main, and should place thereon a tent, or erect a rough board shanty. Would anybody say that such demand was reasonable? Would the obligation of complainants, arising out of their exercise of a public franchise, extend so far as to compel them to excavate the earth and lay down a gas supply pipe to that tent or shanty, and place therein a meter, without proper protection, for the purpose of supplying gas for three months to such a tenant, who might, after all, not use any gas? Suppose, again, a person should rent from month to month one room on the top floor of a many storied building, which the owner had not thought fit to have furnished with gas pipes, and should demand of the gas company that it put in a pipe and "riser" through premises not belonging to it, to supply a single gaslight to a tenant from month to month. Would such a demand be reasonable? In short, is not the obligation to supply a dwelling or tenement

with gas, and for that purpose to lay down a supply pipe and set a meter, subject to the limitation that there shall exist a reasonable expectation that the consumption of gas shall be sufficient to warrant the necessary preliminary expenditure? I think there can be but one answer to these questions.

The principle that the element of reasonableness enters into the practical application in each particular case of the obligation resting on the gas companies was not seriously disputed by counsel of the defendants.

Having set forth the general principles governing the obligation of a gas company to render service I shall consider the different limitations and subdivisions of my topic with particular reference to the laws of California.

The legislature of California early established a policy relative to extensions of gas mains and services in territory in which a gas company professed to give service. In 1863 an act entitled "An act to provide for the Inspection and Sealing of Gas Meters, and for the Protection of Consumers of Illuminating Gas," was passed by the legislature. Section 5, relating to extensions, is as follows:

Upon the application, in writing, of the owner or occupant of any building or premises within one hundred feet of any main laid down by any gas light company, and payment by him of all money due from him to the company, the company shall supply gas as may be required for lighting such building or premises, notwithstanding there may be rent or compensation in arrears for gas supplied, or for meter, pipes, or fittings furnished to a former occupant thereof, unless such owner or occupant shall have undertaken or agreed with the former occupant to pay or to exonerate him from the payment of such arrears, and shall refuse or neglect to pay the same; and if, for the space of ten days after such application, and the deposit of a reasonable sum, as in this Act, provided, (if required), the company shall refuse or neglect to supply gas as required, the company shall forfeit and pay to such applicant the sum of fifty dollars, and the further sum of five dollars for every day thereafter during which such refusal or neglect shall continue, provided, that no such company shall be required to lay service pipe for the purpose of supplying gas to any applicant where serious obstacles exist to laying the same, unless the applicant, if required, shall deposit in advance with the company a sum of money sufficient to pay the cost of his portion of the pipe required to be laid, and the expense of laying such portion.

In 1872 this section of the statute was codified and became Sections 629 and 630 of the Civil Code. The obligation of a gas company under these sections has not been since changed except that extensions not exceeding one hundred feet were made mandatory to supply all gas required whether for lighting the premises or for other purposes such as heat or fuel.

This action of the legislature clearly defined the right of the public to demand extensions and limited the obligation of the gas company in respect thereto, and has been accepted by the companies as reasonable. The right of the legislature under the constitution to impose an additional obligation upon them whereby they were compelled under this section to expend money in improvements which they must have found burdensome, has never been questioned. Before its enactment the law clearly established the principle that it was the duty of a gas company to supply gas impartially to all persons desiring its use within territory in which its business was confined, provided that such persons made the necessary arrangements to receive the gas and comply with the reasonable regulations of the company. From the

earliest days of the gas business suits have been maintained to compel, by the writ of mandamus, a gas company to serve with gas persons along its lines. When this law was passed no case existed to my knowledge which laid down a rule that a company might be compelled to extend its service into new territory except where the express terms of its franchise had obligated it to do so or except where it had for a consideration otherwise agreed to make extensions or betterments.

In December, 1911, the legislature passed what is termed the "Public Utilities Act" which became effective March 23, 1912. By its terms there is conferred on the railroad commission broad powers to compel gas companies, as well as other public utilities, to make extensions and improve facilities. Section 36, which deals with this subject, is as follows:

Whenever the commission, after a hearing had upon its own motion or upon complaint, shall find that additions, repairs or improvements to, or changes in, the existing plant, equipment, apparatus, facilities or other physical property of any public utility or of any two or more public utilities ought reasonably to be made, or that a new structure or structures should be erected, to promote the security or convenience of its employees of the public, or in any other way to secure adequate service or facilities, the commission shall make and serve an order directing that such additions, extensions, repairs, improvements or changes be made or such structure or structures be erected in the manner and within the time specified in said order. If the commission orders the erection of a new structure, it may also fix the site thereof. If any additions, extensions, repairs, improvements or changes, or any new structure or structures which the commission has ordered to be erected, require joint action by two or more public utilities, the commission shall notify the said public utilities that such additions, extensions, repairs, improvements or changes or new structure or structures have been ordered and that the same shall be made at their joint cost, whereupon the said public utilities shall have such reasonable time as the commission may grant within which to agree upon the portion or division of cost of such additions, extensions, repairs, improvements or changes or new structures, which each shall bear. If at the expiration of such time such public utilities shall fail to file with the commission a statement that an agreement has been made for a division or apportionment of the cost or expense of such additions, extensions, repairs, improvements or changes, or new structure or structures, the commission shall have authority, after further hearing, to make an order fixing the proportion of such cost or expense to be borne by each public utility and the manner in which the same shall be paid or secured.

[Here follows a discussion regarding the lack of commission control in municipalities, which has since been settled by the passage of Amendment 28 at the November elections. This gives the commission exclusive power to fix public utility rates in all incorporated municipalities; such municipalities, by vote of electors thereof, may retain that control over public utilities which relate to local, police, sanitary, and other regulations only, or may surrender same to the railroad commission.]

It is my opinion that no power can be vested in any legislature or administrative body to compel service in any territory which the utility does not profess to serve or has never held itself out as willing to serve, or into which it has no legal right to enter.

It has been repeatedly held in California that one owning a water supply is not compelled to dedicate it all to the public use, or that he may dedicate a part

of it only, to such use, reserving the remainder for private purposes or for private sale, or disposition as he sees fit. It was said in the decision of the case of *Del Mar Water, Light & Power Company v. Eshleman*, 47 Cal. Dec. 571, 582, "our decisions have recognized and have repeatedly declared the right of a water company to make such limited dedication and to decline to furnish its water to persons not within the area it has undertaken to serve." The same principle is announced in *Leavitt v. Lassen Irrigation Co.*, 157 Cal. 92; *Thayer v. Cal. Dev. Co.*, 164 Cal. 128; *Hildreth v. Montecito Creek Water Co.*, 139 Cal. 29. A gas company need not expand beyond the limits of the territory which it has chosen to serve.

As to making extensions beyond franchise limits, it will not require authorities to prove that no gas company can be compelled to do an unlawful act. It could not be punished for refusing to tear up streets and lay down pipes where it had no legal authority to operate. Neither can it be compelled to go upon private property with its pipes and mains to supply gas. It does its full duty if it brings the gas to the property line within territory which it has professed to serve with gas and in which it has a legal right to do business.

Despite some loose language in some of the decisions that a company is under an implied obligation to extend its service to all persons living within the limits of the municipality which it is organized and chartered to serve, I maintain that the element of reasonableness enters into the problem in each particular case and the extent of the obligation resting on the gas company to make extensions is measured in each case by the test of reasonableness unless there is an express contract to extend on the part of the company.

In commenting on the case of *Public Service Corporation v. American Lighting Co.*, 67 N. J. Eq. 122, 57 Atl. 482 (1904), where Vice Chancellor Pitney, now Justice of the Supreme Court of the United States, said: "In short, is not the obligation to supply a dwelling or tenement with gas, and for that purpose to lay down a supply pipe and set a meter subject to the limitation, that there shall exist a reasonable expectation that the consumption of gas shall be sufficient to warrant the necessary preliminary expenditure?" Mr. Bruce Wyman, in his recent work on *Public Service Corporations*, states on page 252, as follows:

As this is a relative test it will be seen why comparatively little has to be assured when it is the question of going a few feet off the established mains; the usual consumption of the average customer would secure that. But installation for a single person at some distance from the established mains would not be obligatory in ordinary conditions. Following out the general principle still further, the building of a few houses would call for the extension of a main a little further along a street. But a great deal of business must be shown in order to establish certainly the present obligation to construct new lines into outlying territory. The undertaking to serve a community does not, therefore, lay the company open to outrageous demands in individual cases, but to such service as the community considered as a whole may demand.

The case of *Russel v. Sebastian*, decided April 6, 1914, by the Supreme Court of the United States, has been cited to sustain the proposition that utilities

supplying electricity, gas or water in California have assumed a greater obligation in the matter of making extensions in cities than I have stated to exist. I think when this case is properly understood, and the language read in connection with other decisions of the Supreme Court, that it will be found that the existing rules of law have not been changed in any respect by the decision in the above case.

Prior to October 10, 1911, every utility that desired to supply a city and its inhabitants with light or water could do so without charge or restriction except the giving of indemnity for damage to the streets. On this date there went into effect an amendment to the state constitution whereby cities were given authority to provide in their organic laws conditions and regulations under which light, water, power and heat could be furnished to municipalities.

The Supreme Court of the United States in *Russell v. Sebastian*, above, held that this amendment to the constitution of California, made in 1911, did not affect the right which companies had gained by building works and starting to supply the cities of California with light, heat or power to continue their extensions of service and cover the entire city which they had undertaken to serve. The court held that the constitutional amendment of 1911, and the municipal ordinances adopted under it, were ineffectual to impair this right, and that the company was entitled to extend its mains for the purpose of distributing its supply of gas to the inhabitants of the City of Los Angeles subject to the conditions set forth in the constitutional provision as it stood before the amendment. Justice Hughes, in writing the decision of the court, uses the following language:

This construction of the constitutional provision is the only one that is compatible with the existence of the duty which it was intended, as it seems to us, that the recipient of the state's grant should assume. The service, as has been said, was community service. Incident to the undertaking in response to the state's offer was the obligation to provide facilities that were reasonably adequate. *Lumbard v. Stears*, 4 Cush. 60; *Cumberland Teleph. & Telegh. Co. v. Kelly*, 87 C. C. A. 268, 160 Fed. 316, 324, 15 Ann. Cas. 1210; *Atlantic Coast Line R. Co. v. North Carolina Corp. Commission*, 206 U. S. 1, 27, 51 L. Ed. 933, 945, 27 Sup. Ct. Rep. 585, 11 Ann. Cas. 398; *People ex rel. Woodhaven Gaslight Co. v. Dechan*, 153 N. Y. 528, 533, 47 N. E. 787; *Morawetz Priv. Corp. Sec.* 1129. It would not be said that either a water company or a gas company, establishing its service under the constitutional grant, could stop its mains at its pleasure and withhold its supply by refusing to extend its distributing conduits so as to meet the reasonable requirements of the community. But this duty and the right to serve, embracing the right under the granted privilege to install the means of service, were correlative.

It will be noted that the court in one place states that the obligation was "to provide facilities that were reasonably adequate," and in another place as follows: "It would not be said that either a water company or a gas company, establishing its service under the constitutional grant, could stop its mains at its pleasure and withhold its supply by refusing to extend its distributing conduits so as to meet the reasonable requirements of the community."

The reasoning of the decision of the Supreme Court of the United States in the case of *State of*

Washington, ex rel. O. R. N. & N. Co. v. Fairchild, 224 U. S. 510, upholds the view expressed in this paper. The court, on page 529, states as follows:

Since the decision in *Wisconsin &c. R. R. v. Jacobson*, 179 U. S. 287, there can be no doubt of the power of a state, acting through an administrative body, to require railroad companies to make track connection. But manifestly that does not mean that a commission may compel them to build branch lines, so as to connect roads laying at a distance from each other; nor does it mean that they may be required to make connections at every point where their tracks came close together in city, town and country, regardless of the amount of business to be done, or the number of persons who may utilize the connection if built. The question in each case must be determined in the light of all the facts, and with a just regard to the advantage to be derived by the public and the expense to be incurred by the carrier. For while the question of expense must always be considered (*Chicago & C. R. R. v. Tompkins*, 176 U. S. 167, 174), the weight to be given that fact depends somewhat on the character of the facilities sought. If the order involves the use of property needed in the discharge of those duties which the carrier is bound to perform, then, upon proof of the necessity, the order will be granted, even though "the furnishing of such necessary facilities may occasion an incidental pecuniary loss." But even then the matter of expense is "an important criteria to be taken into view in determining the reasonableness of the orders." *Atlantic Coast Line R. R. v. North Carolina Commission*, 206 U. S. 1, 27; *Missouri Pacific Ry. v. Kansas*, 216 U. S. 262. Where, however, the proceeding is brought to compel a carrier to furnish a facility not included within its absolute duties, the question of expense is of more controlling importance. In determining the reasonableness of such an order the court must consider all the facts—the places and persons interested, the volume of business to be affected, the saving in time and expense to the shipper, as against the cost and loss to the carrier. On a consideration of such and similar facts the question of public necessity and the reasonableness of the order must be determined. This was done in *Wisconsin R. R. v. Jacobson*, in which for the first time, it was decided that a state commission might compel two competing interstate roads to connect their tracks.

[To be continued.]

Producer gas from wood is being investigated by the U. S. Forest Service. It has been estimated that 1,500,000 cords of wood waste is consumed annually as refuse in the Pacific Northwest. This would be sufficient to yield 195,000,000,000 cubic feet of producer gas, and develop from it 1,125,000,000 kilowatt hours of electric energy. Thus far, the most extensive development of wood gas producers has been in France and Sweden. Plants are operated also in England, India and Mexico. In this country, there are a few producer plants operating in the South and Southwest. In the former region, producer gas is being generated from wood waste, composed of 50 per cent sawdust and 50 per cent sawmill hog. The cost for brake horsepower hour was found to be 22½ mills, half of which was for fuel and half for labor. Using coal in the same way, the cost was a fraction over 28 mills to the brake horsepower hour, 7½ mills being for labor. Through these various operations, it has been found that wood as compared with coal gives little ash and that is easily removable; it gives a higher grade of gas with much less tar, and the cost is lower for a uniform quality.

RATE REGULATION IN CALIFORNIA CITIES.

Following the enactment of the constitutional amendment giving the California Railroad Commission the authority to fix rates of public service corporations in cities, the question arises as to what effect this new condition will have upon several long-standing contentions between cities and water and light companies operating within their limits.

In the first place, it is pointed out that this section does not go into effect until the intention of the amendment is made operative by action of the state legislature. However, no doubt is entertained but that the legislature will take this action promptly.

Another fundamental feature in the new conditions will be that the Railroad Commission will not make new gas, electric, telephone and water rates periodically. The procedure has been to make new rates each year, going into effect on July 1st. The commission, it is stated, will follow its custom in the matter of railroad charges of inquiring into the justice of a rate only when it is questioned upon complaint, or when the situation seems to warrant its acting on its own initiative.

But with the public utility rates in 200 California cities coming under its jurisdiction at one time it is not considered probable that the commission will initiate any changes of its own motion at once.

In several cases the commission will enter upon contentions that have aroused bitter feelings, and it is intimated that among its first decisions may be some that will not be popular. In Los Angeles, for example, the elective officers of the people have been contending for some time for a cheap gas rate. Such contentions, it is intimated, have been carried on more in a political than a scientific atmosphere.

In several cases, as in the rates of the Spring Valley Water Company and the Pacific Gas & Electric Company in San Francisco, suits are in progress in the courts.

In connection with the amendment giving the commission the authority to make valuations of public utility properties for purposes of purchase by municipalities, the claim of the Railroad Commission is that it has had this power under the former laws. It has exercised it in the cases of Eureka, Fort Bragg and Glendale, where water plants have been purchased at the valuation made by the commission. In this procedure the city is free to quit the purchase plan, but the company may be forced to accept the commission's valuation in a court action in which the commission's figures are not questioned. It is understood that the commission stood ready to take this action in the Spring Valley matter, but that it was not requested to do so by the city administration.

Control Surrendered.

The following are incorporated cities and towns of California which already had surrendered to the Railroad Commission their control over some or all the public utilities within their boundaries:

Palo Alto, Willits, Orange, Sonoma, Monterey, Salinas, Eagle Rock, Antioch, Ontario, Belvedere, Daly City, San Jose, Huntington Beach, Taft, Petaluma, San Rafael, Oroville, Claremont, Oakland, Bakersfield, Napa, San Leandro, Mill Valley, Oakdale, Vallejo, Newport Beach, Kennett, San Anselmo, Sis-

son, Hemet, Santa Maria, Tracy, Sonora, Redondo Beach, Morgan Hill, San Mateo, Pacific Grove, Paso Robles, Hermosa Beach, Redlands, Inglewood, St. Helena, Los Gatos, Sausalito, Corona, Hollister, National City, Huntington Park, Hayward, South Pasadena, Dixon, Sunnyvale, Long Beach, Santa Monica, El Centro, Redding, Los Banos and Alhambra.

Approximately 200 incorporated cities and towns, including most of the largest municipalities in the State, have not surrendered the rate making power to the commission, but will be brought under its authority when the necessary action is taken by the legislature at the coming session.

SURVEY OF CONNECTED LOAD.

The Utah Light & Traction Company is engaged in making a connected load survey of all of its residence, commercial and power customers in Salt Lake City. Fifteen men are engaged on the work and it is expected that it will be completed by January 1, 1915. Each customer is visited and all of his lights, appliances and motors are listed, the nature of the work done by a machine is recorded, so that this information taken in conjunction with the customer's consumption over a period of a year will furnish a large amount of valuable information.

A letter is mailed to the customer in advance of the visit of the canvasser stating the purpose of the visit and inviting the customer to make any suggestions that she may wish with reference to her service. In addition to securing first hand information in regard to the customer's installation and prospects for additional business, the company is obtaining by means of this canvass many suggestions which will enable them to avoid friction and mistakes in the future.

The canvasser carries a pad of inquiry slips and any questions from the customer in regard to irons, percolators, toasters, ranges, etc., are noted and are turned over to the New Business Department for follow-up. In this way many leads are being secured which will undoubtedly result in a considerable increase in revenue due to the addition of customers on appliances.

The most frequent questions are in regard to the possibilities of electric cooking. A large proportion of the women appear to be much interested in the subject and many have expressed a determination to install an electric range in the spring as a result of the demonstrations they have seen in the company's electric shop, at the State Fair, and elsewhere. The information obtained by the canvasser on the data cards is transcribed to a permanent customer's data card which will be used by the New Business Department in connection with new business campaigns which are contemplated in the future.

A Diesel-electric car, similar to the gas-electric car, is being successfully operated between Rastatt and Gernsack, in Saxon, Germany. The Diesel engine has a capacity of 147 kw. and operates at 450 r.p.m., with control apparatus reducing the speed to 200 r.p.m. The engine has six cylinders and operates on the four cycle principle. At a speed of 45 miles per hour the operation is quiet and the vibration not troublesome.

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POWER AND GAS

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Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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The Oregon Society of Engineers has just undertaken the task of organizing an American association for the universal adoption of the metric system of weights and measures. Their efforts are worthy of support and should have the hearty endorsement of every progressive engineer. It is nearly fifty years since the metric system was legalized in the United States; everyone concedes its convenience and value; the public has been educated as to its methods, and yet we continue to conservatively cling to the older system in all the dealings of everyday life.

Many efforts have been made in the past to bring about a more general use of the metric system in America. The scientific men were the first to recognize the utility of this rational standard, the engineering societies usually employ a dual notation of weights and measures in their proceedings, and gradually the engineers are becoming accustomed to think in the metric system.

There is probably nothing, except a universal language and a universal monetary system, which is more vital to the international commerce the United States is now seeking, than an international system of weights and measures. This the metric system is destined to be, because of its superiority over any other system and because of the convenience of the decimal notation. It permits a standard of quantity which is as necessary as a standard of quality in getting and holding foreign trade. It promotes a better understanding between buyer and seller and thus helps to establish confidence.

The chief objection to the change has come from manufacturers who have employed the older system of dimensions in the design of their patterns and tools, which have been made with great accuracy and whose abandonment would represent a heavy expense. Yet these manufacturers have been among the first to advocate a standardization of sizes and are now working to that end. A standardization of units of measurement is a necessary preliminary to a standardization of machinery.

The efficiency of the metric system is far greater than the other. This refers not only to simplifying calculation, but also to eliminating the inconvenience, confusion and waste of time in converting from the one to the other. We see this not only in foreign exchange, but also in domestic commerce. How much more convenient would be the metric wire gauge of France than the half-dozen or more gauges now used for measuring wire in America. The electrical units of measurement have been based upon the metric system and are now employed universally, so that there is no confusion of meaning.

Germany did not legalize the metric system until two years after the United States took action, but by making its use obligatory the new measures were soon universally employed in all works and calculations. This has been a great factor in upbuilding German commerce and industry, especially in articles where precision of measurement and interchangeability of parts are essential.

The same arguments which apply to the adoption of a universal language are even more apt in urg-

ing the metric system of weights and measures. Weights and measures, like languages, are used subconsciously. A linguist does not feel that he has full command of a language until he is able to think in it. When a people intuitively think in centimeters and grams rather than inches and pounds, they will unconsciously adopt the former. It is the inertia of the subconscious mind which must first be overcome.

The result can be eventually attained by the gradual process of education, but it now seems opportune that there should be an executive order. Fable reports that plans were once made for a simultaneous shout from every individual on the earth in order to signal Mars. When the given moment arrived every one except a deaf old lady in Texas waited to hear how big a noise the others would make. Likewise with the metric system—everybody is waiting for everybody else to adopt it. If the postoffice issued an order that no newspapers or periodicals would be granted second-class privileges unless the metric system were employed in all articles, if copyright were contingent upon the same observance, or if Federal job-holders were under like obligations, the desired result would be accomplished very quickly.

An interesting question has been brought to light by a provision in the charter of Bakersfield, California, which defines ice as a public utility.

What Constitutes a Public Utility The high cost of ice has been responsible for the death of many infants who had been fed spoiled milk and public regulation of ice companies is believed to be the best way to solve the problem. While such public control is certainly a necessity, it is doubtful whether it can ever be accomplished on the legal contention that ice is a public utility. To serve ice to the public differs far more from public service than the mere placing of an another "e" in serv(e)ice.

A definition of a public utility, that is at once concise and complete, is difficult to formulate. If considered as "a private company which exercises its functions in a direction that is of vital importance to the members of the community reached by its activities," a broad interpretation will bring many callings within this classification. In such a sense coal is as much a public utility as is ice—for infants, milk, and for adults, food, should likewise be included. Where shall the line be drawn?

The public service commissions usually have jurisdiction over common carriers, pipe lines, gas, electric, water, telephone and telegraph companies, wharfingers and warehousemen, and define these callings as public utilities.

The one point which these several services possess in common is the necessity to first obtain a franchise over public property before they can do business. To do so it is necessary that they have the right of eminent domain. Furthermore governmental co-operation is essential to their successful operation. An ice or a coal company do not now come within these limitations.

Broadly speaking, there is little reason why this arbitrary division should always prevail. The socialistic tendency is to make every business more or less of a public utility. Civilization is essentially a process

of converting luxuries into necessities. In a complex civilization ice is as much a necessity as transportation.

For the present, however, it is advisable to abide by the established limitations, especially as such control as is exercised by the pure food and drug act and the Sherman act offer adequate protection to the consumer. Many communities have recently forbidden an unwarranted increase in price because of war conditions, without attempting to define food-stuffs as public utilities, and the same sentiment should be effective in limiting the profits of the ice men.

As a matter of fact, within a comparatively few years, the delivery of ice will be almost as rare as the delivery of candles. Inventors and manufacturers are rapidly bringing the cost of an electric driven ice machine within the reach of every householder. With electric cold, electric heat and electric lights, the ice man, the coal man and the candle man will rapidly be eliminated from our economic civilization.

In connection with the problem of reducing the inductive effects of high tension power lines on telephone and telegraph circuits many expensive experiments have already been conducted. The results, to date, have been mostly of a negative character, as indicated by the recent order of the California Railroad Commission. While the troubles can be partially mitigated by sectionalization and transposition of lines, as well as prohibiting the use of apparatus otherwise desirable, no effective method has yet been devised for fully protecting communication circuits against high-frequency power surges.

What appears simple in theory is difficult to attain in practice. In chemistry, it is an easy matter to neutralize an acid condition by adding just enough alkali to form a salt, a suitable indicator like litmus showing the neutral point; in mechanics, an equilibrium can always be established between unbalanced forces; and even in electrical circuits, a neutralizing transformer can be designed to compensate for constant low frequency induction.

An interesting set of experiments have recently been completed in this direction along the line of the New Haven single-phase railroad under the direction of Chas. F. Scott. By paralleling the communication circuits with a primary wire subject to the same inductive influences, and connecting it to a transformer the electromotive force of whose secondary is equal and opposite to the induced primary, an opposing current is introduced in the communication circuit to balance the induction effect from the power line. While this scheme enabled telegraph operation in close proximity to the single-phase railway circuits, it did not eliminate the residual voltages due to the higher harmonics. In commercial practice the noise disturbances are still troublesome and the added resistance and capacity reduce the efficiency of communication.

Yet such experiments are only the forerunners of a line of investigation which should ultimately overcome the difficulties. The problem is essentially one for the engineer and not for the lawyer. It is believed that engineering ingenuity will finally devise a means whereby the telephone and power man can live in harmony, each with the other.

PERSONALS

William Burns, electrical contractor of Minneapolis, was a recent Seattle visitor.

K. G. Dunn, vice-president Hunt, Mirk & Company, of San Francisco is at Los Angeles.

A. B. Saurman, Pacific Coast manager Standard Underground Cable Company, is at Seattle.

F. N. Averill, manager of the Fobes Supply Company, has returned to Portland from Seattle.

E. G. Wilson, electrical contractor of Napa, Cal., was a recent business visitor at San Francisco.

Roy Demaree, manager Dinuba Electrical Works, of Dinuba, Cal., was in San Francisco last week.

M. F. Steel, salesman Benjamin Electric Manufacturing Company of San Francisco is at Los Angeles.

H. D. Brainerd of the Seattle branch of the Western Electric Company, has been transferred to the New York City office.

P. N. Longan, comptroller Mt. Whitney Power & Electric Company, of Visalia, was in San Francisco the latter part of the week.

R. M. Pike, president of the Yolo Water & Power Company, recently returned to San Francisco from a business trip to New York.

W. D. Thomas, representative Electric Railway & Manufacturers' Supply Company, is traveling throughout the southern part of California.

J. Paulding Edwards, consulting electrical engineer, specializing on electric railways, has opened offices in the Flatiron building, San Francisco.

E. M. Cutting, Pacific Coast manager Edison Storage Battery Supply Company, is making a business trip throughout the southern part of California.

J. Harry Pieper, engineer illumination and vehicles for Southern California Edison Company, has been elected president of the Los Angeles Ad. Club.

A. G. Wishon, general manager San Joaquin Light & Power Company, and A. E. Wishon, assistant general manager, are at San Francisco for the week.

J. B. Rowray, who resigned as general manager of the Northern Electric Company at Chico when a receiver was appointed, has succeeded W. R. Lawson, resigned, as superintendent of the road.

Ross Hartley, Portland manager of the Pacific States Electric Company, has been given charge of the Seattle office of that company. F. N. Killam, formerly manager at Seattle, is now with the San Francisco office.

H. T. Van Riper, traveling representative of the Pacific Electric Heating Company, of Ontario, Cal., is in Salt Lake City on his regular trip through the Inter-Mountain territory and will return to Los Angeles and the factory next week.

L. W. Shugg, advertising department of the General Electric Company of Schenectady, New York, recently arrived in San Francisco, where he expects to spend a few months in connection with the Panama-Pacific International Exposition.

W. D. Standrod of Pocatello has resigned as a member of the Idaho public utilities commission. For several months Judge Standrod has contemplated taking this action. He leaves the employ of the state for personal reasons, as he has other matters at hand to which he intends to devote his attention.

T. A. McDowell, manager, meter department of the Westinghouse Electric & Manufacturing Company of Pittsburgh, Pa., with M. C. Schnederberg, manager of the switch board department, will be in San Francisco on the 23d, 24th, and 25th of this month. They are on their annual tour of inspection.

W. L. Goodwin, vice-president, Pacific States Electric Company, and R. M. Alvord, sales manager General Electric Company of San Francisco, have returned from a few days' business trip throughout the southern part of the State, during which they were attendants at the quarterly meeting of the California Electrical Contractors' Association at Los Angeles.

MEETING NOTICES.

San Francisco Section A. I. E. E.

The regular meeting of the San Francisco Section of the American Institute of Electrical Engineers will be held in the Engineers' Club, Hotel Sutter, at 8 p. m., November 20. A series of fifteen minutes papers devoted to a "Symposium on Sporadic Insulations" will be read by P. M. Downing, Harris J. Ryan, J. E. Woodbridge and J. P. Jollyman.

Seattle Section A. I. E. E.

The November meeting of the Seattle Section of the American Institute of Electrical Engineers was held on Tuesday evening, November 17th, in the Assembly room on the top floor of the Central Building. A short paper on "The Repulsion Motor," was read by W. M. Strickler, and a series of talks on "The 'Breaking In' Period of the Engineering Graduate," was given by C. E. Magnusson, A. A. Miller, J. D. Ross, M. T. Crawford, J. R. King, L. F. Curtis, and E. A. Loew.

Utah Electric Club.

At the regular luncheon of the Utah Electric Club at the Commercial Club, Salt Lake City, November 12th, Dr. Chas. D. Stewart of the Stewart X-Ray Laboratory gave a most interesting talk on the X-Ray and its application to medicine and surgery, accompanying his talk with lantern slide illustrations of a few of the many thousands of X-Ray photographs which he has made for physicians and surgeons in the Inter-Mountain territory in the last ten years. These photographs and Dr. Stewart's talk brought out most forcibly the valuable service which the X-Ray has rendered to the human kind by permitting the correct diagnosis of injuries and diseases and greatly simplifying the treatment of these cases.

Joint Meeting Portland A. I. E. E. and N. E. L. A. Section.

A rousing meeting of the Portland sections of the A. I. E. E. and the N. E. L. A. was held in the new Pacific Telephone Building in Portland, Oregon, on November 10th. The entire program was arranged by the telephone members of the sections. The paper on "The Telephone Plant With Relation to Fires" called forth a spirited discussion from Messrs. Friendly, Searing, Scott, Weber and Battalion, Chief Stevens of the Portland Fire Department.

After the technical section was adjourned the members were divided into small parties in charge of telephone men who escorted them through the building. The guides illustrated at various points, the practical working of the exchange by operating the apparatus for the benefit of the visitors. The next meeting has been postponed until December 15.

Oregon Society Engineers.

The November 9th Monday Luncheon of the Oregon Society of Engineers, was addressed by O. M. Plummer, secretary and treasurer of the Portland Union Stock Yards Company and member of the Portland school board, on "Our School situation." The chairman of the day was Mr. Walter H. Graves, land clearing engineer and president of the Oregon Society of Engineers. Mr. Plummer pointed out that Portland's new school houses had many new and novel features such as swimming pools in the basements and play grounds on the roofs; and also only class A buildings can be built for school purposes as the city ordinances will permit nothing else. He said that the school board desired the cooperation of the Oregon Society of Engineers so as to ob-

tain the best efficiency in handling the school affairs. He also pointed out that the ordinary citizen did not take enough interest in the school board affairs and there was no public board which could so easily spend public money without being criticised, as the school board. Nevertheless the board desired co-operation and advice.

The regular monthly meeting of the Oregon Society of Engineers was held in the Public Library Building, room A, November 12, 1914. J. C. Stevens made his report on the "Metric System of Measures." This caused an extended discussion, and finally it was decided to form a committee to organize an American Association for the universal adoption of the metric systems of measures, and all technical associations will be asked to aid in the movement. Also Miss M. Dixon, technical librarian for the Multnomah County Library Association, gave a short talk on co-operation between the library and the Oregon Society of Engineers.

Jovial Electrical League of Southern California.

The weekly luncheon of the league, held at Christopher's on November 11th, was attended by over 100 Jovians and friends, and was presided over by Ted. E. Burger as chairman of the day. Tribune Pieper, who was congratulated on his recent election as president of the Los Angeles Advertising Club, read a telegram of greeting from Jovians Francis and Van Kuran, who are on their way eastward. He also announced the appointment by Jupiter Niesz of A. E. Morphy as Chief Stentor for this district and the following assignments

Congressman 13th district, James G. Pomeroy, No. 820.
Statesman California and Arizona, James N. Colkitt, No. 2627.

First Tribune, Los Angeles, J. Harry Pieper, No. 11868.

Second Tribune, Los Angeles, H. F. Anderson, No. 10705.

The three-minute talks by members on the personal and business characteristics of three other Jovians, mentioned in our last issue, afforded much amusement, and will be repeated at succeeding meetings. An interesting correspondence, which "perhaps" passed between Messrs. Pieper and Burger, regarding the correctness of the word "electrical" or "electric," when used in connection with the word "league," was read by Mr. Burger and the wordy battle was declared a draw. The same will, no doubt, be continued until some authority will act as umpire and satisfy the contestants. After the rendition of a splendid musical program, the chairman introduced Frank G. Tyrrell, who delivered an eloquent and helpful address on "Business Ideals." He spoke of the power and mastery of business ideals and necessity and importance of ideals in our relationship with help, for good will among the men working for us frequently spells the success of an enterprise. He urged his hearers to remember that the manside of a job is frequently more important than the product side.

LETTERS THAT WIN.

St. Louis, Mo., August 25, 1914.

Friend Jovian:

I want to give you a few FACTS, which I believe you have failed to realize, and as they may be somewhat unpleasant for you to absorb, I ask you to read the letter through before you get "peevish," and then see if you don't agree with me that the Order is more mistreated by having to write it than you are by having to read it.

This is the FOURTH notice, since last October, asking you to pay TWO DOLLARS, which represent your YEARLY DUES to the Jovian Order. Outside of the labor involved in filling out invoices, addressing envelopes, etc., and the pain of the brain-throbs we expended to try and concoct the previous notices so they would not hurt your feel-

ings (because we realize a dun is an unpleasant sort of animal at best) it costs the Order a lot of perfectly good money that we could use for practical work for YOUR benefit and that of all our members.

JUST THINK A MOMENT! We try to be courteous, so, all these notices are sent under two-cent postage—that's EIGHT CENTS—4 PER CENT OF YOUR DUES! The other expense—and it is probably as much again—is,

Typist, invoices and envelopes.

Four envelopes—in which invoices and return addressed envelopes are enclosed.

Four return addressed envelopes—enclosed to save YOU the trouble of addressing ONE.

Four invoices with your potential typed on face.

Three printed notices—worded so that Chesterfield himself would have gloated over them.

This letter.

That's a lot of lost motion for the collection of TWO DOLLARS, now, honest, don't you agree with us?

Sincerely yours in Jovianism,

ELL C. BENNETT.

No. 3932-13, Twelfth Mercury.

P.S.—If you didn't receive other notices, sorry, but we've used the address you gave us.—B.

San Francisco, Cal., Oct. 26, 1914.

Dear Brother Mercury:

Your most interesting and unique letter, or in fact brutal dun (an unpleasant sort of an animal at the best) was absorbed, but I was not peeved, and being in Sin-crow-nis-him with your views, can offer no resistance to my Worthy Jovian Mercury Bennett, because he is a good conductor of electricity, so herewith enclose my No. 9310 Potential flow of 2½ amperes capacity direct current-cy to you, thus allowing a fair and liberal allowance for the overload on your service and the short circuit in my power station, and as you rotate this brief current literature with frequency with us both on neutral relations, it becomes apparent that your cycle of duns were more or less shunted.

I can't conceive how any good Jovian could refuse to pay his over due wattage, especially when he has such a good field to lag in, in fact if I oh-m any more current-cy allow me to transmit a vote of thanks to you for being in synchronism for my rotors enclosed. I hardly think an efficient Jovian you could put up a better torque with the right polarity could ever get by with such an inductance without being electrocuted. His specific gravity has to my knowledge never been paralleled and his power factor more than compensates me for the lag in my current-cy.

Well, I have shunted this letter with good lamentations and when you are through commutating my electrical hieroglyphics and it don't phase your carrying capacity, just sit right down like an efficient vulcan like we have out here and mail my primary receipt to the fields of dear old California, S. F. And in terminating my epistle allow me to state that if by chance you should ever get a short-circuit over the lines of the S. P. or Santa Fe R. R. to the above terminal, I would be pleased to rotate you and our live-wire bunch of high efficiency units out to see the world-famous cliff house waves and saturate your accumulator with Exide solution from the plates and porcelain of this famous resort.

I am quite positive that your brief stay with us will not be in the negative and the impressions we will endeavor to leave on your lag will more than offset the expenditure on your expense account.

Trusting to have the pleasure of meeting you face to face and in appreciation of your high Power-Factor, I beg to remain, all to-gether-all the time—for everything electrical.

Yours and then some,

W. R. BAKER.

NEWS OF WASHINGTON PUBLIC SERVICE COMMISSION.

Members of the public service commission plan to attend the annual convention of railroad commissioners at Washington, D. C., this month. Chairman C. A. Reynolds will return via California.

Engineers of the public service commission are taking an inventory of the properties of the Key City Power & Light Company at Port Townsend preliminary to fixing a valuation on the plant.

The commission has ordered the Pacific Telephone & Telegraph Company to supply service to the Hazelwood district from the Spokane exchange.

The commission has denied and dismissed the petition of Morris. vs. Puget Sound Traction, Light & Power Company, that a car route be re-established on Broadway, between Jefferson and Jackson streets, Seattle.

The commission has set the following causes for hearing: December 8, Everett, Commission vs. Pac. N. W. Traction Co., Travis vs. Pac. N. W. Trac. Co., Brown vs. Pac. N. W. Trac. Co.; December 12, Everett, Commission vs. Everett Gas Co., Hendrie vs. Everett Gas Co.; December 15, Seattle, rules and regulations Tel. Co.; December 16, Seattle, Seattle vs. Seattle Light Co.; December 21, Port Townsend, Commission vs. Key City Light & Power Co.; December 4, Tacoma, Commission vs. Puget Sound Electric Railway; December 21, Tacoma, Oscar Klocker vs. Key City Light & Power Co.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision denying the application of the Southern Pacific Company for a rehearing of the transbay commutation rate case. In this case the railroad company sought to raise all its commutation rates as between San Francisco on one side and Oakland, Berkeley, Alameda and other cities on the other side.

The commission has issued a supplemental order authorizing the Southern California Edison Company to sell \$134,000 of its 5 per cent bonds at not less than 86 per cent of their face value.

The Marin County Electric Railways has filed an amended application with the Railroad Commission requesting authority to start construction work at Mill Valley on private funds, pending the sale of the stock and of the receipt of deferred payments on stock already subscribed. The commission in its previous decision authorized the railway company to start construction work when \$35,000 received from the sale of stock had been deposited in Marin County banks.

The commission has rendered a decision authorizing the Southern California Edison Company to issue \$784,000 face value of its 5 per cent bonds falling due November 1, 1930. Two hundred and sixty-six thousand dollars of these bonds may be issued at once, provided the company receives therefor not less than 86 per cent of their face value, plus accrued interest. The proceeds from the sale of this portion of the issue will be used by the company in paying promissory notes amounting to \$250,000. The commission's order provides that the remaining \$518,000 face value of the bonds shall not be issued until the commission has made a further order specifying the minimum price at which they shall be sold and the specific purposes to which the proceeds shall be applied.

The Long Beach Consolidated Gas Company has filed an application with the commission for a certificate of public convenience and necessity to operate a gas distributing system in certain portions of Orange County.

CIVIL SERVICE EXAMINATION HYDRO-ELECTRICAL ENGINEER.

The United States Civil Service Commission announces an examination for hydro-electrical engineer to fill a vacancy in the Quartermaster Corps of the Army, for service at Camp John Hay, Philippine Islands. The salary of this position is

\$2400 per year. It is desired to secure a man thoroughly familiar with the installation, construction and operation of hydro-electrical plants, including pipe lines, and with experience in testing, installing and operating them. The plant at Camp John Hay is to be operated by Pelton water wheels. Competitors will not be assembled for examination, but will be rated on general education and technical training (40 points), and practical experience and fitness (60 points). A general knowledge of the laws of electricity and magnetism, and a practical knowledge of the design, construction and testing of dynamos, motors and auxiliary electrical apparatus, hydraulic turbines, impulse wheels and mechanical auxiliaries of a hydro-electric power plant, is a prerequisite for consideration for this position. Applicants must have had at least six years' practical experience, of which two must have been in the constructing and installing of electric and hydro-electric machinery, and four years' experience in mechanical and electrical engineering. Of these four years, two must have been in the practical operation of a hydro-electric power plant. Graduation from a technical school of recognized standing will be accepted as equivalent to one year of the above required practical experience. Statements as to training, experience and fitness will be accepted subject to verification. Applicants must have reached their twenty-fifth, but not their forty-fifth birthday on the date of examination.

TRADE NOTES.

American Circular Loom Company announce the removal of its main office to 90 West street, New York City.

J. J. Agutter & Company have been awarded the contract for the wiring in the Y. M. C. A. Building at Bellingham.

The Home Electric Company of Portland has been awarded the contract for \$10,000 worth of incandescent lamps for the city.

R. J. Holterman, formerly with Holabird-Reynolds Co., has opened a new electric shop at 535 Market street, San Francisco.

The Alaska Electric Light & Power Company of Juneau, Alaska, will operate with fuel oil in the future. They have just completed a tank with a capacity of 15,000 gallons.

The Allis-Chalmers Company has been awarded the contract for building the new substation at Smith Cove by the Seattle Port Commission. The contract price was \$5760.

The contract for the First Avenue curb lighting system in Spokane has been awarded to the William E. Chase Engineering Company, for \$66,429. Posts are to be pressed steel bodies.

Apfel & Jansen, electrical contractors of Seattle, have secured the contract for the installation of the Apfel system of electric heating in the general offices of the Great Western Stove Company, Seattle.

The contract has been authorized for the direct pumping units for the Sunnyside unit of the Yakima irrigation project, Sunnyside, Wash., to the Pelton Water Wheel Company of San Francisco, for \$7954.

E. C. Leighton, electrical engineer of Seattle, has been awarded the contract for the wiring and lighting of the Hanford street warehouse by the Seattle Port Commission. The contract price was \$4035.

The United States Navy has placed orders for six engines for submarines with the Busch-Diesel Engine Company of St. Louis. Each engine will be of 800 h.p. and two engines promised to have the engines ready within a year.

each are intended for submarine L-5, L-6 and L-7, now being built at Bridgeport, Conn. The Busch-Diesel Company has

Ralph B. Clapp, manufacturers' agent, San Fernando Building, Los Angeles, has recently arranged to represent the Electrical Engineers' Equipment Company, Electric Magnetic Tool Company, and the Pittsburgh Transformer Company in

California, Arizona and Nevada, in addition to those he has been handling in Southern California—Harvey, Hubbell, Inc., American Circular Loom Company, and Stanley & Patterson.

M. C. Baker & Son have recently opened an electric shop at 636 Market street, San Francisco. In addition to contracting and sales work, special facilities have been installed for repairing and testing electric meters and instruments, as well as caring for laboratory work. I. H. McCarthy, an electrical engineer of wide experience in industrial application has recently joined forces with Mr. Baker and the firm is prepared to handle anything electrical.

A new sign receptacle is being marketed by the Bryant Electric Company of Bridgeport, Conn. This receptacle goes into a 1½ in. hole and requires no lug or slot to prevent it from turning. It is prevented from turning by three fins on the front portion of the porcelain, which bite into the metal of the sign as the two portions of the receptacle are brought together with the center screw. The center screw does not come into direct contact with the center contact of the lamp and therefore there is no tendency for the screw to loosen by friction of the lamp on the screw-head. The entire front portion of the receptacle can be removed and replaced without disturbing the line connections. Since the receptacle goes into a perfectly smooth hole, it can be set in any desired position and then be positively prevented from turning by tightening the center screw.

Eureka, California, celebrated the driving of the golden spike of its first railroad October 23d. This railroad—the Northwestern Pacific—was financed jointly by the Southern Pacific and the Santa Fe Railways. It connects San Francisco with Eureka, a distance of 291 miles, by means of a line running between the Coast Range mountains and the ocean. Eureka, and tributary territory, rich in timber and wonderfully fertile soil, has heretofore depended solely on sea transportation. The opening of the new railroad is the most vital and important event which could happen to the city and territory. The electric light and power requirements of Eureka and surrounding towns and villages and the gas requirements of Eureka are served by the Eureka Division of the Western States Gas & Electric Company, which the growth and prosperity of the community will very favorably affect.

Plans and specifications have been completed by Hurlburt & Rands, engineers, Henry Building, Portland, and bids are now being received by the South Fork Water Commission at Oregon City until 2 p. m., November 21, for the construction of the water supply system between Oregon City and Clackamas. The work is to consist of about 25 miles of pipe and the construction of a large reservoir to have a capacity of 5,000,000 gallons. Alternate bids will be received for wood and steel pipe. In wood pipe construction there will be 13 miles of machine banded wood stave pipe, of the 18 in. size and 12 miles of 16 in.. The steel pipe will be either lap welded or riveted. The bids for the reservoir will also be for alternate figures, for a concrete lined and open reservoir and reinforced concrete construction. Including this, there will be 43 tons of cast iron pipe and fittings for the reservoir equipment and a pumping house.

The commercial department of the Utah Light & Traction Co. has just entered into a contract with Mr. Brigham Whitmore, builder of the Whitmore Apartments, for the sale to him of 26 Four "K" Simplex Electric Ranges to equip the twenty-six apartment building which he is just completing at the corner of First South and Second West street, Salt Lake City. This will be the first apartment house in Salt Lake City to be completely equipped with electric ranges. It required considerable work on the part of the company's representative to convince Mr. Whitmore that the equipment of his apartment houses with electric ranges would serve as an inducement for people to occupy them, especially in view of the fact that they are located on the west

side of the city where he must depend upon working men with moderate salaries for his tenants. Several of them had already engaged apartments in the building, and one of the company's representatives went with the owner to interview these tenants and without exception they all stated that they would prefer to use electric ranges even though the cost were somewhat higher and that this would be quite an inducement for them to engage apartments. These visits quickly decided the owner to install electric ranges and indicated that the educational work which the company has been doing for the past several years on the subject of cooking with electricity has begun to bear fruit.

PACIFIC COAST GAS ASSOCIATION.

About seventy-five members of the Pacific Coast Gas Association met at dinner in the Engineers' Club, San Francisco, on the evening of November 17th. E. C. Jones, president of the Association and of the American Gas Institute, outlined the plans which have been perfected for holding a collective exhibit of gas apparatus and appliance at the Panama-Pacific Exposition, reading many letters and telegrams which assure the success of the plan. D. E. Keppelman told of the valiant work which was done at the recent meeting of the American Gas Institute to make this exhibit possible. John A. Britton, who presided at the meeting, appointed John G. Redd superintendent of the exhibits, and named the following committee to look after their receipt and care: Frank A. Cressy Jr. of Modesto, chairman; F. A. Leach, C. B. Babcock, R. S. Thompson, D. E. Keppelman, F. C. Millard, Paul Hough, H. P. Pitts, H. R. Basford and R. S. Pederson.

This meeting was also made the occasion for presenting the medals which were awarded to the writers of the best papers presented at the Long Beach meeting of the Association in September, R. S. Thompson, H. R. Basford, B. F. Pederson, C. B. Babcock and H. P. Pitts.

BOOKS RECEIVED.

American Handbook for Electrical Engineers, compiled by a staff of specialists, Harold Pender, editor-in-chief; 2023 pp.; 4x7 in.; thin paper; leather bound. Published by John Wiley & Sons; for sale by Technical Book Shop, Crossley Bldg., San Francisco. Price \$5.00.

The eternal "why" is the first greeting for a new handbook. Aside from the fact that engineering in general, and electrical engineering in particular, is progressing so rapidly that new books must appear with a frequency which taxes the pocket book this work represents a number of innovations which make it welcome and greatly enhances its value.

The most noticeable feature is its encyclopedic make-up, a series of complete articles alphabetically arranged. This facilitates ready reference which is further augmented by the very complete index. In addition a topical list of articles has been prepared in lieu of the usual table of contents.

This list comprises twenty-four main headings, each with from five to forty sub-headings. The main headings include such widely diversified topics as engineering materials, principles of electricity and magnetism, instruments and apparatus, transmission and distribution, industrial application of electricity, steam engineering and hydraulic engineering. The sections on calculating alternating current phenomena are especially complete, clear and concise.

Because of this diversity the book is equally good for electrical engineers interested in the principles of other branches of engineering or for other engineers interested in the application of electricity to their problems.

The treatment is essentially from the standpoint of the practical man, with fine-type development of the theory behind the principles for those interested.

With much to praise and little to criticize this volume is really indispensable to the kit of every progressive engineer,



NEWS NOTES



FINANCIAL.

SEATTLE, WASH.—Bids will be received until November 28 for the purchase of \$404,000 light extension bonds of the city. Issued in \$100 denominations.

NOME, A. T.—A. J. McConnell, general manager of Seward Peninsula Power Company is on the way east to interest financiers in plans for the improvement and enlargement of the local utility plant.

SAN FRANCISCO, CAL.—A 5 per cent \$100 bond of the Municipal Street Railways has been prepared by John E. McDougald, city treasurer. Twenty-five thousand of these bonds are ready for issuance and will be placed on sale at the treasurer's office December 1.

SEATTLE, WASH.—When City Comptroller Carroll hears from Caldwell, Masslich & Reed, bond buyers of New York, as to the legality of the steps taken by the city to sell the \$404,000 light extension bond issue over the counter in \$100 blocks, advertisements of the sale will be prepared.

SEATTLE, WASH.—The receivers of the Seattle, Renton & Southern Street Railway have offered to sell to the city of Seattle that portion of the railway within the city limits for \$200,000 in municipal railway bonds at $4\frac{1}{2}$ per cent interest and 20 per cent of the gross earnings of the property for 28 years, the city in no case to pay more than \$1,300,000 for the property in excess of the \$200,000 in bonds, which represents the first payment.

INCORPORATIONS.

SAN DIEGO, CAL.—The Pauma Valley Water Company has filed articles of incorporation in the office of the county clerk. The capital is \$300,000 and the incorporators are Monta J. Moore, J. C. Adams and G. M. Henderson. The purpose is to irrigate 12,000 acres of land in Pauma rancho.

POCATELLO, IDAHO.—The Grande Canyon Canal & Power Company has been organized with a capital stock of \$200,000. The company is incorporated to enter into a general hydroelectric power business, to build electric transmission lines, irrigation canals, to operate electric plants of all kinds, to develop oil wells, and timber holdings. Dr. Sidney W. Badcon is president.

PHOENIX, ARIZ.—Articles of incorporation of the Machinery & Electrical Company have been filed with the county recorder. The company, which is formed to carry on the business of installing all machinery for electrical, gas and steam heating, ventilating and lighting plants has a capital stock of \$50,000, to be divided into 500 shares, each of the par value of \$100. The list of incorporators bears the names of E. A. Trincano, C. E. Scrivner, F. E. Rich and Reese M. Ling, all of Phoenix.

ILLUMINATION.

STOCKTON, CAL.—Included in the lighting plans for 1915 are electroliers for the business district.

FELLOWS, CAL.—If plans are carried out Lost Hill will have a natural gas system. Joseph Loeb is organizing a gas company.

LOS ANGELES, CAL.—Plans for supplying natural gas to all the houses in the San Fernando Fruit Farms subdivision are under consideration.

NORTH YAKIMA, WASH.—The city commissioners have passed a resolution calling a special election for December to vote on Yakima Heating Company electric franchise.

WATSONVILLE, CAL.—The contract has been awarded for installing an electrolier lighting system in East Third from Main to Alexander to the T. Electric Company.

PORTLAND, ORE.—A contract for remodeling lighting in Columbia Park and the construction of a lighting system in Peninsula Park has been awarded to M. J. Walsh & Co., for \$2,238.

LOS ANGELES, CAL.—The park commission will consider new plans for the proposed ornamental lighting of Exposition Park. The original plans cannot be carried out because of lack of funds.

SPOKANE, WASH.—Petitions will be filed with the city council for the lighting of Sprague avenue from Division to Cedar street and Trent avenue from Division to Lincoln with artistic electroliers. The estimated cost is \$110,000.

HERMOSA BEACH, CAL.—An effort is being made by residents on Pier avenue in the Camino Real district, to establish an ornamental lighting system from the city limits of Hermosa Beach to the city limits of Manhattan Beach.

SANTA BARBARA, CAL.—Sealed bids will be received by the board of supervisors of Santa Barbara county up to December 7th, for a 50 year franchise to operate a system of gas pipes and other appliances for distribution of gas along public highways in portions of the county.

NEWPORT, CAL.—The board of trustees has accepted the bid of F. O. Engstrum Company to install 139 standard street lights, using the new American Cement Products Company's marbleite posts. They were the only bidders, contract being let at \$14,968, with extra cost of \$20 each for marbleite posts.

ASHLAND, ORE.—At a recent council meeting the question was brought up of bonds for an auxiliary electric light plant, including a new building and equipment about a mile down the canyon from the present plant and a reservoir on the top of Crowson hill. The plans call for the bonding of the city for \$32,000 for the light plans and \$10,000 for waterworks improvements.

OAKLAND, CAL.—The city council received bids for furnishing and installing special lighting fixtures for the main rotunda of the city hall, council chamber and mayor's offices, as follows. H. S. Tittle, \$24,700; Thomas Day Co., \$27,560; Tiffany Studios, \$31,700; Maxwell Hardware Co., \$35,999; the English Co., \$39,262. The bids were referred to the City Attorney and Commissioner of Public Works.

TACOMA, WASH.—At a meeting of the council recommendations were made for extensive lighting plans for immediate placing in various parts of the city. Include territory from Cliff avenue to Yakima avenue between N 3d and N 6th streets and streets between and the alley crossings. Ornamental lights are to be placed on South D street from South Seventh street to South Twenty-first and on Jefferson avenue from Pacific avenue to South Twenty-first street and on South Seventeenth street from Pacific to D street. Steel poles are recommended.

TRANSMISSION.

SAN FRANCISCO, CAL.—The department of electricity has called for 50 standards for fire alarm boxes, which will be placed down town. They will be connected with the auxiliary alarm system as well as the central alarm station.

LEWISTON, IDAHO.—Engineer J. W. Morris of Portland, Ore., has filed a report on the dam across Clearwater, for hydroelectric development. Mr. Morris estimates that a plant to develop 2350 kw. would cost \$488,102 and for the development of 3412 kw. \$508,863.

PASCO, WASH.—Captain Gray will undertake to prevail on the Weyerhaeuser interests to construct a dam and power plant at Five Mile Rapids on the Snake River, a site which has great power possibilities. It is estimated that from 60

to 100,000 horsepower can be developed by damming the river at that point.

SAN FRANCISCO, CAL.—The works board has awarded to T. E. Davis & Son for \$13,269 the contract for constructing a shop building for the department of electricity on the city's lot on Golden Gate avenue, between Leavenworth and Hyde streets. It is expected that this building will be ready next January. The department's present quarters in the Civic Center will then be torn down. The new alarm station in Jefferson square is now being equipped.

SALEM, ORE.—Because of error committed by Circuit Judge McGinn in instructing the jury, the Supreme Court, in an opinion written by Justice Eakin, has reversed him in the case of Willis D. Hoag vs. the Washington-Oregon Corporation. The plaintiff alleged that through the negligence of the company, a current of electricity was turned on while he was engaged in repairing its lines, and he was badly burned and disfigured. He brought the suit, the jury gave him a judgment for \$30,000 and the company appealed. "This judgment must be reversed upon the authority of the Schulte case and remanded for a new trial," said the court. "The statute provides that an employer having charge of any work involving risk or danger to employes shall use every precaution practicable for the safety of life and limb, and the manager and superintendent in charge of the work shall be held to be the agent of the employer. The court instructed the jury as to the common law liability of the defendant company, and went into detail as to three elements of the common law liability, namely, the fellow servant rule, the assumed risk and contributory negligence; but these elements are a defense in a common law action and are affected by the statute of 1910. The first two elements are entirely eliminated by the statute, and one is modified, but the instruction of the court wholly failed to enlighten the jury as to what facts would take the case out of that state, and the jury was left entirely in the dark on that question. The case was clearly a case of an owner doing the work of repairing or altering a structure, involving danger, and came under the statute, and whether proper care and precaution were used, or contributory negligence was established as an element to affect the amount of damages, should have been presented to the jury."

TRANSPORTATION.

SAN FRANCISCO, CAL.—The completion of the Municipal Railway line along Chestnut street skirting the entire front of the Exposition grounds, marks the beginning of passenger traffic from the Ferry along Van Ness avenue, directly to the Fillmore and Scott street entrances.

SAN FRANCISCO, CAL.—At a recent meeting of the Mission Promotion Association, President Eustace Cullinan reported that eight improvement clubs had joined the Mission Association in protesting against the construction of a cable road on Church street. These organizations have requested the supervisors to rescind its action instructing the city engineer to prepare plans for the construction of such a system.

TELEPHONE AND TELEGRAPH.

LOS ANGELES, CAL.—The application of the San Pedro Home Telephone Company for a telephone franchise at Wilmington, has been referred to the city attorney for a report thereon.

SAN FRANCISCO, CAL.—The board of supervisors unanimously adopted the compromise suggested by the public utilities committee in the matter of the Home Telephone Company's franchise. Under the proposed agreement the Pacific States Company will be allowed to purchase the Home Telephone Company's franchise and on its part will pay the city 2 per cent of its gross revenues, which will amount to about \$72,000 per year at the present rate of business.

WILLOWS, CAL.—A. H. Quatman, local resident, has secured an option of sixty-six and two-thirds per cent of the Glenn County Telephone Company's stock. He intends to sell the stock of the immediate future. Quatman refuses to reveal the name of the proposed purchaser, but says he is an "independent operator." It is believed here that the ultimate owner of the company after the transfer of stock will be the Pacific Telephone & Telegraph Company. Quatman's options call for the payment of between 50 and 60 cents on the dollar for the stock, the number of shares determining the price paid.

SALEM, ORE.—Permission to increase its rates so its net revenues may be between 7 and 8 per cent has been granted the Interurban Telephone Company of Silverton, by the State Railroad Commission. The commission found the actual value of the plant to be \$17,702, and reproduction cost to be \$25,231. Its operating expenses for 1913 were \$4,938.78 and its net revenue \$2,561.63. New rates authorized by the commission are as follows: Business telephones, one-party, monthly, \$2.25; two-party, \$2; four-party, \$1.75. Residence telephones: One-party, \$1.75; two-party, \$1.50 and four-party, \$1.25. The rate for farmer-party lines is \$5 a year.

ASTORIA, ORE.—The Marconi Wireless Telegraph Company has started preliminary work on the erection of a new wireless station on the south side of Young's Bay near Astoria. The new plant is to be the most powerful on the coast north of Bolinas Bay and is to have a 25 kw. equipment capable of sending a distance of 3500 miles at night. Four self-supporting steel towers are to be erected, each 10 ft. by 10 ft. in plan at the base and 300 ft. high. The towers will be placed at the corners of a 300 ft. by 600 ft. rectangle, which is to be the size of the aerial. The completed station is to cost from \$70,000 to \$80,000 and will have a working force of four men, a chief and three operators.

WATERWORKS.

EVERETT, WASH.—The city commission has decided to select an engineer and award a contract for the municipal water project.

SAN FRANCISCO, CAL.—It has been practically decided that the Spring Valley water bond election will not be held until next March.

RED BLUFF, CAL.—An election in the matter of bonding Red Bluff in the sum of \$85,000 for establishing a municipal water system to be held December 10th.

SPOKANE, WASH.—Steel water mains will be laid at the expense of the city water improvement fund in Kiernan avenue. This was decided by City Commissioner Fassett.

CLYDE PARK, MONT.—The low bid for the installation of waterworks system for which bonds in the amount of \$13,000 were recently voted was submitted by C. H. Green Company, Spokane.

AMITY, ORE.—The city council is taking steps toward putting the matter of voting bonds for waterworks before the people. Not over \$15,000 bonds would be required and in all probability only \$12,000 would be needed.

WARRENTON, ORE.—At a special election held here bonds in the sum of \$150,000 were voted for the purpose of constructing a water system. The pipe line will extend from the Lewis & Clark River a distance of 16 miles.

ST. IGNATIUS, MONT.—Bids will be receipted until December 15 by the U. S. Reclamation Service for the construction of 38 miles of canals and laterals involving excavation of about 106,000 square yards of material.

LOS ANGELES, CAL.—The Malabar District Improvement Association has requested that action be taken to install a more efficient water system in the district bounded by Ganahl, Wabash, Indiana and Brooklyn avenue. The request was referred to the public service committee with favorable recommendation from the council.

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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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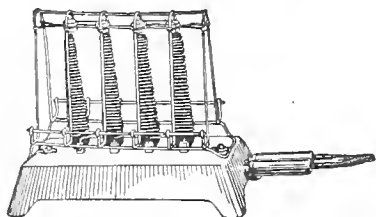
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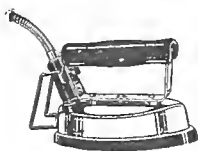
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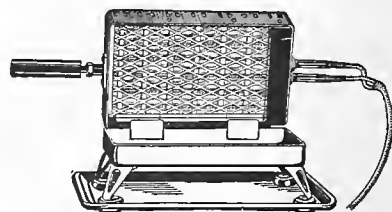
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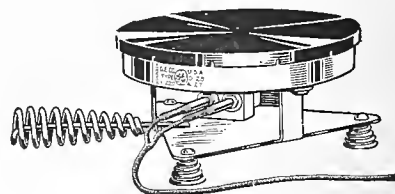
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P. P. I. E. GAS EXHIBIT

One of the most important steps ever taken in the gas industry is the decision of the American Gas Institute to endorse a collective gas exhibit at the Panama-Pacific International Exposition. Through the well-directed efforts of E. C. Jones, newly-elected president of the Institute and chief gas engineer for the Pacific Gas & Electric Company, arrangements have been completed for the reservation of 10,000 sq. ft. in the northwestern portion of the great Palace of Manufacturers and plans are now well advanced for a most comprehensive exhibit.

Engineers of London will be represented and papers have been promised from foreign countries throughout the world. A conservative estimate places the probable attendance as at least one thousand.

Nearly one-fourth of the possible exhibitors in this section promised to make a showing before any systematic effort had been made to secure them, and from present indications the space will be heavily over-subscribed.

Designs are now being made for a beautiful pavilion as a housing for the collective exhibits, with every



Palace of Manufacturers, P. P. I. E.

This is the first time that a collective exhibit of gas appliances has ever been planned for an international exposition. Heretofore exhibits have been scattered over a wide area and the magnitude of the gas industry has not been evident. The exhibit will be of peculiar value in connection with the International Gas Congress which will be assembled at San Francisco during the week of September 27, 1915. The various gas associations throughout the United States have nearly 8000 members. The Institution of Gas

opportunity to display the application of gas for lighting and heating. Sixty exhibit spaces have been arranged and an active campaign has been started by John B. Redd of San Francisco, who will supervise the local work. His efforts will be ably seconded by a committee appointed by John A. Britton, consisting of Frank A. Cressy Jr. of Modesto, chairman; F. A. Leach, C. B. Babcock, R. S. Thompson, D. E. Keppelman, F. C. Millard, Paul Hough, H. P. Pitts, H. R. Basford, R. S. Pederson and E. C. Jones.

THE USE OF MOVING PICTURES FOR ENGINEERING PURPOSES.

BY E. N. PERCY.

In taking up this subject, engineering is referred to in the broadest sense of the word, meaning the commercial engineer as he exists today in the fields of civil, mechanical, electrical, sanitary and other departments. The purely technical engineer is becoming less known, and engineering work becomes more and more a problem of meeting commercial requirements and selling goods. Our industries are now managed by engineers and the policies are shaped to suit engineering ideas. The sales departments are in charge of engineers, and the goods are sold along engineering lines. They are also purchased by engineers to comply with specifications drawn by other engineers. Engineers as a class find themselves confronted with the problems of design, manufacture, distribution, sales and maintenance. In these fields the cinematograph can be very useful, as has been already proven. Its uses are naturally divided into two classes. First, purely scientific. Second, advertising.

As ordinarily exhibited for the benefit of audiences, cinematograph pictures are shown at the rate of sixteen per second, each sixteen pictures occupying one foot of film. The principles of the moving picture are so well known that they need not be explained in this article. For scientific purposes cinematography is governed by two considerations. First, the speed at which the picture is taken; second, the magnification at which it is taken. For scientific purposes these speeds vary from 30,000 exposures per second to as little as one exposure per hour, or even one exposure per day. The extremely high speeds are used for photographing bullets in their flight, the bursting of soap bubbles, the action of explosives, the action of jets of water, and other high speed phenomena. The low speeds are used to illustrate the construction of large buildings, the growth of a flower, the development of an animal, or changes in structural materials. All of these pictures are then reduced to normal speed for projection.

The magnification ranges from that used by the highest power ultra-microscope to the opposite extreme, presenting on a small screen the map of an entire country, or views taken from an aeroplane, or telescopic views of the heavens. Both the speed and the magnification are differentials dependent upon each other, as well as upon the subject under consideration.

With such possibilities, it is easy to conceive that the cinematograph can be useful to the engineering industry as a whole. Many high speed processes, such as the flow of steam, air and gases, combustion and explosions, automobile engines, the action of governors, the synchronism of generators, the flow of water in turbine wheels and water wheels, the action of woodworking machinery, the action of machine tools, etc., may be photographed at high speed, and reduced to a speed in which the action may be studied with the utmost accuracy. For instance, a rifle bullet, or an exploding shell has been shown on the screen no faster than the crawl of a fly. The slow speeds are adaptable to structural work of any

kind, the fatigue of metals, the testing of various materials extending over a period of days, etc. Use has already been made of this system to record motions made by workmen, with a view to improving them in accordance with the new studies in efficiency.

The magnification may be made use of by sanitary engineers to record the development of bacteria over a period of time, the condition of water, etc. It may be made use of by municipal engineers to record the condition of a street over a period of weeks, not only in its entirety, but detail specimens of the materials used, the value of the cinematograph in these various works being that it illustrates the microscopic examination in its entirety.

Up to the present time the great weakness of microscopic examination has been that any given plate shows only a fraction of the examination as pursued by the inspector. The possibilities of microscopic examination are endless in their application and examination of materials, manufactured products, chemicals, minerals, etc. Agriculture is now approaching engineering so closely that mention may be made of the use of the cinematograph for studying insects, and the development of fruit, together with the development of pests, in conjunction with the microscope. Without doubt, great strides could be made in this field. The Marey Institute in Paris, incorporated by Dr. Marey, now deceased, under the guidance of Pathe Freres, is one of the very few institutes of this kind now in existence, another one in Belgium having been destroyed by the war. An institution of this kind is now being developed on the Pacific Coast, and no doubt excellent work will be done.

The cinematograph opens up an entirely new means of advertising. Advertising naturally divides itself into two great classes—general and specific. General advertising must make use of general mediums, such as will make a general appeal for goods offered to the household, or personal things, or things for the office, or the auto, grocers, jewelers, etc. Examples of things requiring specific advertising, appealing through specific mediums, to a specific class, are things mechanical, electrical, scientific, sanitary, structural, medical, surgical, agricultural or musical. Films for advertising purposes, like any other form of advertising, must, in each instance, be composed to suit the mind, and the state of mind of the specific class to which it is addressed. This is governed to some extent by the places at which it is possible to exhibit these films.

These may be divided into three classes, viz: private, expositions or fairs, and public theaters. These three divisions of exhibits cause the film composition to be divided into three classes, as follows: First, for private exhibition and study, the films should be highly technical, as they are intended simply for the study of the firm, its interested representatives, and its most important customers, or their engineers.

The second class of film, intended for expositions and fairs, is addressed to a serious-minded people, who as a rule, are seeking points of interest and information, yet would have no patience with highly technical subjects. In other words, this second class of film must be industrially interesting. It may show the in-

interesting points of an industry, its magnitude, its great stocks of merchandise, the various processes in the factory, and most important of all, correct methods of using the products. Such films must be full of action where possible, and no one view or scene should be shown for more than fifteen or twenty seconds without a change. No processes should be shown more than once, and tediousness of any kind cannot be tolerated. The hardest thing for a manufacturer to remember is that his business is not as interesting for the world as it is to himself, unless he makes it so.

The third class of film, intended for public theaters, "movies," &c., must be popularly interesting, and this feature must predominate absolutely at the expense of any industrial consideration. Otherwise, the circuits will not accept the film. For instance, one of the best films prepared by a well known shoe company, for advertising purposes, showed a moving picture, most fortunately obtained when its factory burned up, followed by a slow picture taken during the erection of its new factory. This followed in turn by a trick film, showing its various models of shoes with dancers, clowns, &c., apparently of miniature size, climbing out of them. These were followed by other equally spectacular scenes, all of which blended into a good advertising film, acceptable to popular theaters. On the other hand, to illustrate the use of the cinematograph for scientific purposes, an automatic pistol manufacturer had a high speed film taken of the mechanism of his make of revolver when in action. When the pictures were developed and slowed down for projection, fine grains of powder were seen slowly leaving the mechanism, as it worked slowly on the screen, showing that the cartridges were overloaded. This defect was remedied by the manufacturer.

Many of these scientific films can be used for exhibitions, and even for theater work, provided they have proper titles and explanations to make them interesting. Well known trademarks can be used, provided they are followed by an illustrated use of the product, and this may be followed by an illustration of possible harm resulting from not using it. All of these points, of course, require experts in order to be properly worked up.

To get such films before the public it is necessary to approach some of the large exchanges at headquarters. As a rule, they will not pay anything for an industrial film unless of extraordinary popular interest, but they in turn do receive something for the film from the theater. They object, as a rule, to advertising head-lines or titles or any mention of the firm name in the explanatory titles, but on the other hand, it is possible to introduce the firm name into the pictures on wagons, store fronts, packages, etc.

These pictures, like any other form of advertising, may be in accordance with a general policy of publicity, or with a specific policy to keep some name before the public, or a specific policy to explain a certain product, or certain virtues of a product, but in any case, must have a definite object according with a definite policy of advertising, the same as in any other form of advertising.

It is well known that much money is lost in ad-

vertising, and can be lost in the same way by the use of moving pictures not in accord with some definite object of advertising policy. The cost of getting up a film of this character varies from \$1.00 to \$5.00 a foot, including traveling expenses, film and incidentals. An industrial film for private purposes may be of any length, a thousand feet taking from twenty minutes to half an hour for inspection. One or two thousand feet is usually as much as can be used at exhibitions and fairs, and is usually accompanied by a lecturer. Five hundred to one thousand feet is as much as the average theater will pay for unless of the most extraordinary interest. The exchange will usually request from half a dozen to a dozen prints of a good film. These prints will cost in the neighborhood of ten cents a foot each. In case a manufacturer is fortunate enough to have his material accepted by one of the large exchanges, they may require as many as one hundred prints, but in this case some arrangement would be made, as such exchanges do not accept films unless there is a good prospect of remuneration. Money in a general way, is no object to the theater man unless it comes from the audience, because it would be folly for him to screen anything not of absorbing interest to his clientele, regardless of inducements which might be offered him.

There are many free-lance camera men now available for all kinds of work, but for reliable production it is wiser for intending exhibitors to patronize reliable firms, who are in a position to guarantee results. The country at this time, and for the last few years, has been covered with moving picture producers who start into the business with insufficient capital, connections and skill, and the majority of them are failing, several having failed in San Francisco within the last few months. However, an industry of this kind is bound to have some setbacks, and the period is now at hand when scientific and industrial possibilities will be enlarged upon, particularly as the public is somewhat tired of drama, adventure and sensationalism, in substantiation of which we note the increasing popularity of the news weeklies and scientific films.

CANAL TRANSPORTATION TELEPHONE SYSTEM.

In order to facilitate the despatch of vessels through the Panama Canal, by insuring prompt and certain communication between the various points of operating control, a special telephone system has been installed, connecting on one line, in series, the offices of the port captains, the control houses at the locks, the Gamboa signal station, the Dredging Division, and the office of the Superintendent of Canal Transportation. Each station has its call signal, in combination of long and short rings, and there is a general signal for the attention of all. Thus, at one speaking, any of the operating stations can communicate information to all the others. For instance, when a vessel clears from a terminal harbor to make the transit of the canal, say from Cristobal, the office of the port captain at Cristobal will sound a general call; all the other offices will "Listen in" and the message will be delivered.

INDUSTRIAL USES OF FUEL OIL.

BY F. B. DUNN.

(Continued.)

Boiler Furnace Arrangement.

The construction of the furnace for oil varies with the type of boiler and the class of burner used. It is the most important part of the installation, but until recently has received the least attention by the engineers. It is in the furnace that the proper combustion of the oil must take place. A slight difference in the amount of air admitted may mean a great loss of heat units. It is an easy matter to secure a smokeless fire, but efficiency can only be obtained by having a carefully designed furnace.

Fig. 12 shows the method of applying oil to a return tubular boiler employed by many engineers. It will be noticed that the air is supplied from the rear end of the boiler, and is compelled to travel the entire length of the furnace, under the grate, before entering the combustion chamber. Thus the air is pre-

between the ash pan and the furnace, and provides the furnace with preheated air, which is an important aid to rapid combustion.

Fig. 15 shows the furnace arrangement under the Parker boiler. The former grate bar level has not been changed; a layer of fire brick properly spaced over the grate bars was all that was necessary to change to oil fuel.

Fig. 16 illustrates another furnace arrangement for a B. & W. boiler. The grate bars are lowered a few inches and then covered with a layer of fire brick. In spacing the fire brick, it is common practice to leave out one whole brick about five inches in front of the burner. The other bricks, for a distance of three feet from the front, are left about one inch apart, allowing the air for combustion to pass up and through the flame. The air is thus heated by coming into contact with the hot bricks. The spread and length of the flame can be regulated by the spacing of the fire bricks.

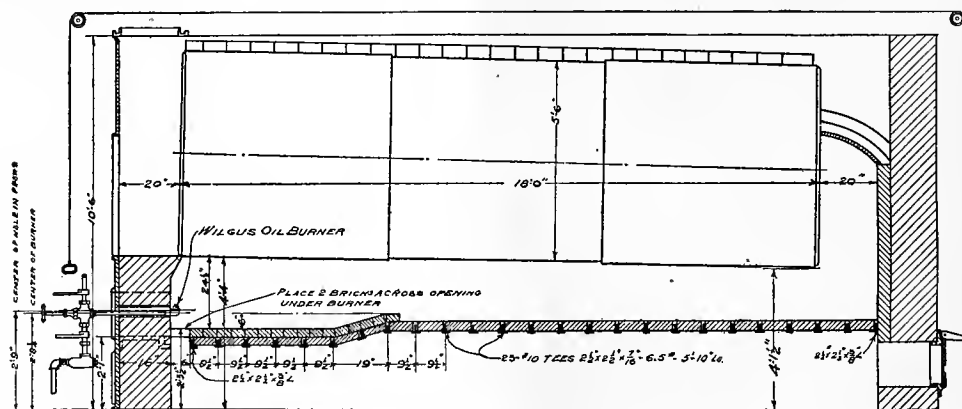


Fig. 12. Setting for Wilgus Burner Under Return Tubular Boiler.

heated before entering the fire box. Fig. 13 shows a patent furnace arrangement, with the burner placed at the back end of the furnace. This type of furnace has been successfully applied to water tube boilers of various designs. Fig. 14 illustrates the burner and furnace arrangements for the Coen system as applied to B. & W. marine boilers. It will be noticed that the regular coal firing doors have been moved from the furnace front, and special air regulating fronts substituted. The burners are located as shown; one in each doorway, and the main flow of air for combustion is regulated by a sliding plate surrounding the burner. Auxiliary air is admitted through the ash pit doors.

An important feature of the interior furnace arrangement is the provision for a current of insulating air to circulate from the back to the front end of the furnace, between the ash pan and the furnace deck. This is accomplished by cutting two air openings of sufficient area in the back of the furnace and constructing an air duct $2\frac{1}{2}$ in. in height, running from front to back the full width of the furnace. When these rear doors are open, which is the case only when the fires are in operation, a current of air is admitted which travels rapidly forward through the ducts, entering the combustion chamber through the firing arches in front of the burners. This circulating air serves a double purpose; it affords perfect insulation

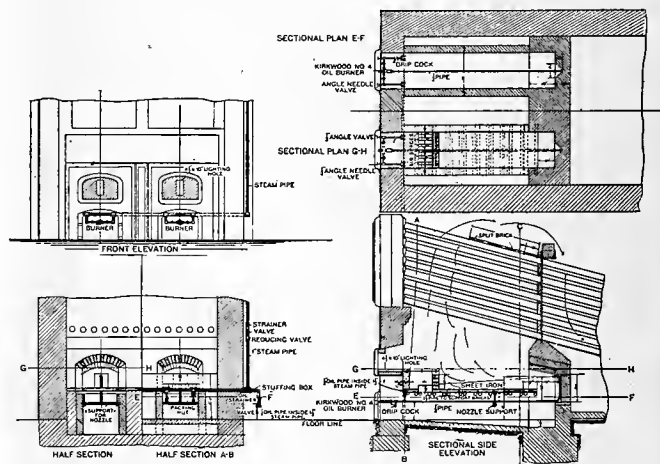


Fig. 13. Setting for No. 4 Kirkwood Burner Under Water Tube Boilers.

Fig. 17, 18 and 19 show the general arrangement of the S. & P. burner as applied to the Scotch marine boiler. The grate bars are entirely removed, as are the bridge wall and front dead plate. A ring of fire brick is fitted in the throat of the furnace and a number of old grate bars are placed on an incline. On account of the round shape of the furnace they are cut off as shown in Fig. 18. A single layer of fire brick is placed over these bars and spaced as shown in Fig. 19. When forced draft is used the openings 1 and 2 are closed. The necessary air is regulated by the damper

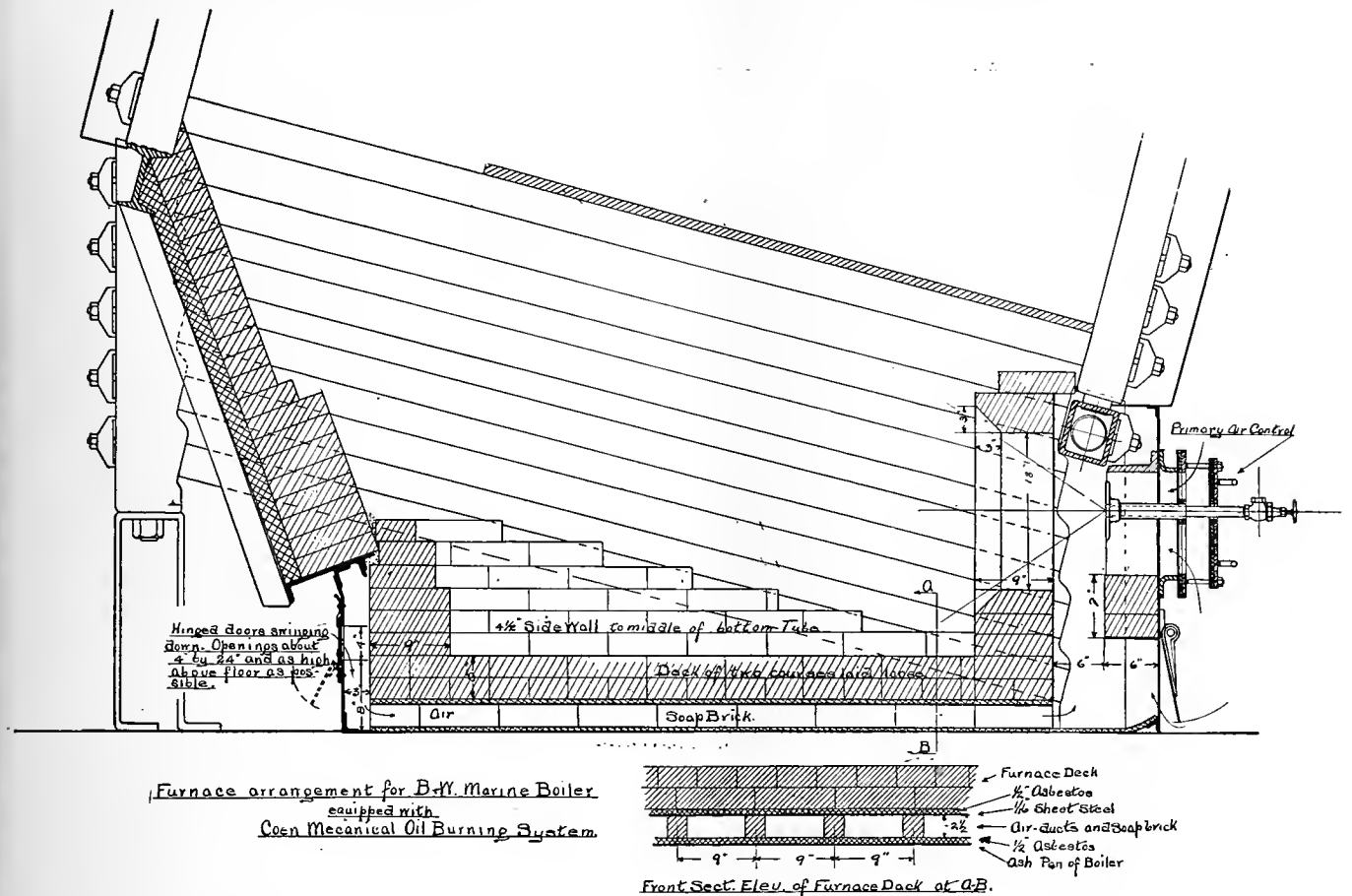


Fig. 14. Furnace Arrangement Under B. & W. Boiler.

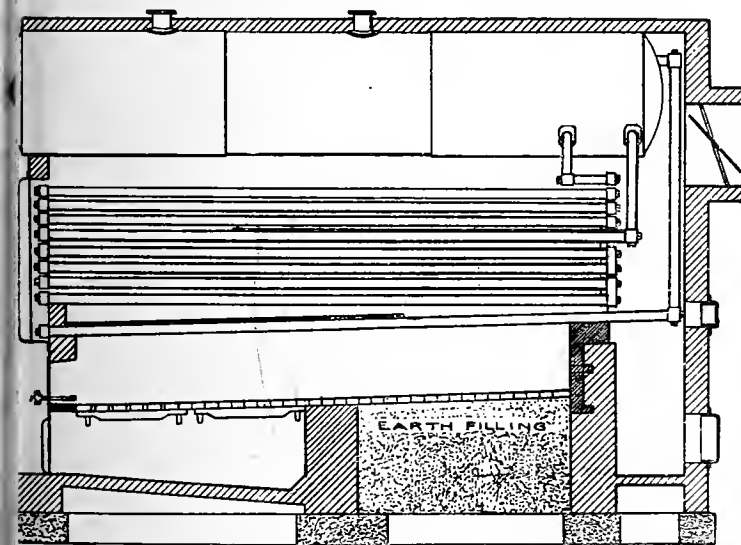


Fig. 15. S. & P. Furnace Arrangement Under Parker Boiler.

C. The burner is placed as shown, generally five inches above the fire brick. This type of furnace arrangement has been used with great success by many of the large steamship companies operating on the Pacific Coast.

Fig. 20 shows the application of a Wilgus oil burner to an upright boiler. A 3 in. tube is expanded through the water leg of the boiler, in which the burner is placed. A ring of fire brick about 14 in. in height is placed around the sides of the furnace; fire brick are also placed about 1 in. apart on top of the

grate bars. By this arrangement the boiler can readily be used for wood or other fuel, by simply removing the burner. Many plants burning oil use this type of boiler for getting up steam required for pumping systems and burners operating the main boilers, after having been closed down on Sundays or holidays.

Much better furnace efficiency can be secured by having an oil burning expert inspect the furnaces when a change to oil fuel is contemplated. Such an expert will design a furnace front without expensive grate bars, bearing bars, or other fittings that a salesman might be anxious to install, and at the same time provide a furnace from which the highest efficiency may be secured. The vital importance of correct design and construction of furnaces will be further emphasized in a chapter on combustion.

The required height of chimney for fuel-oil plants is much less than is ordinarily supposed when the boilers are operating at or below their rated capacity, and considerably greater than is usually supposed when there are heavy over-loads. As pointed out by Mr. C. R. Weymouth, of San Francisco, Cal., in a paper read before the American Society of Mechanical Engineers, a chimney of undue height will take an excessive quantity of air for combustion and permit an excessive load on the boilers, both resulting in a large waste of fuel. When the chimney height is limited to that necessary for economical air supply at the desired boiler load, it will be impossible for the most careless fireman to cause serious waste of fuel, either by supplying excessive air, or seriously overloading the boilers. The chimney may thus become

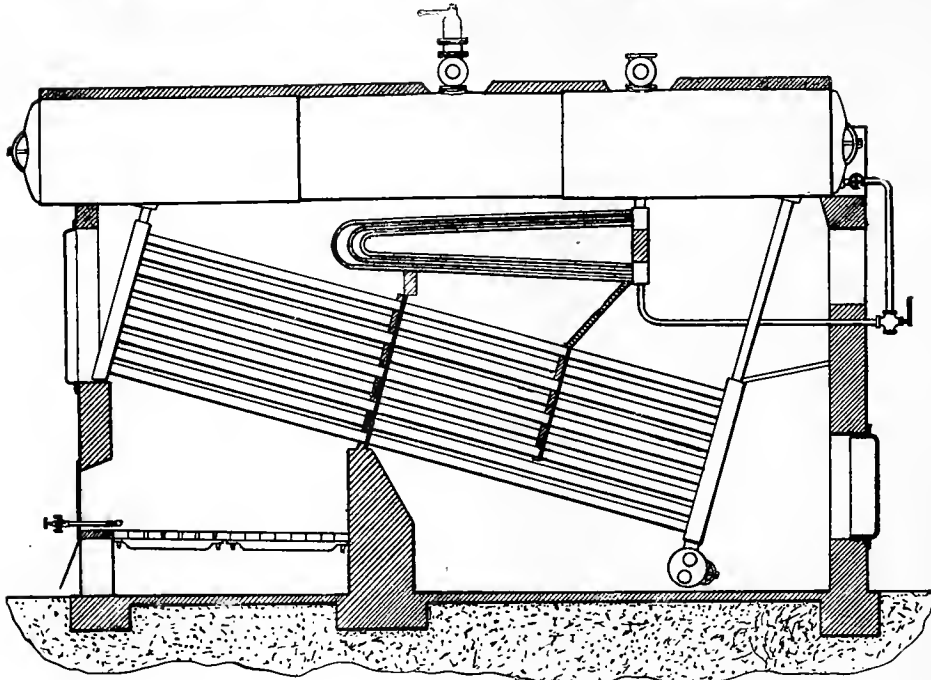


Fig. 16. S. & P. Furnace Arrangement Under B. & W. Boiler.

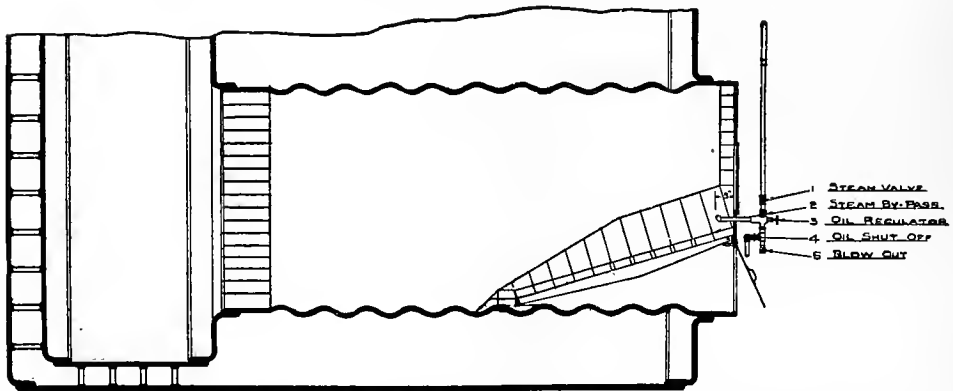


Fig. 17. Longitudinal View of Burner Arrangement for Scotch Marine Boiler.

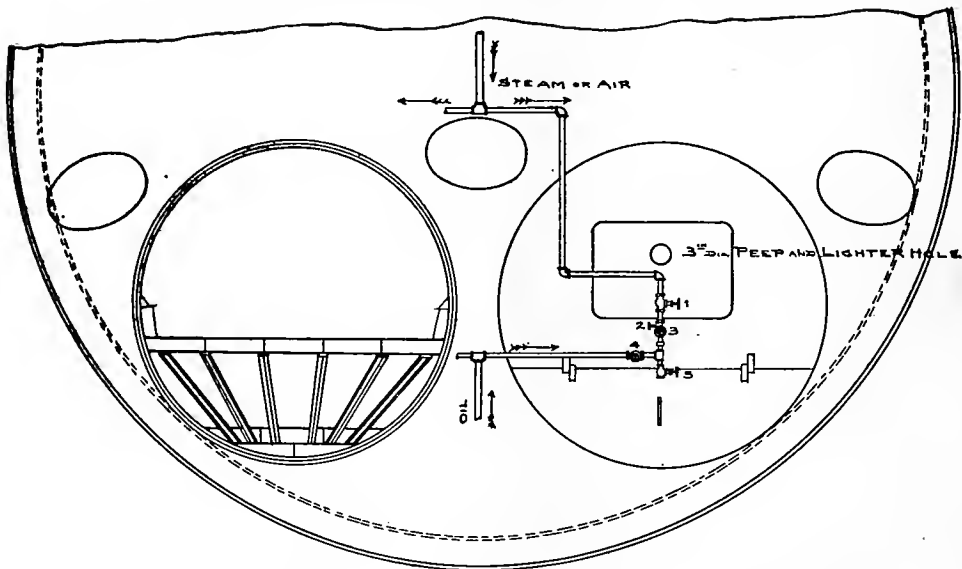


Fig. 18. Cross Section of Burner Arrangement for Scotch Marine Boiler.

an important and inexpensive means of regulating boiler-plants, and an automatic safeguard against careless firing. Such service is, of course, most successfully secured only in plants operating at uniform load.

The San Francisco earthquake of April 18, 1906,

considerably reduced the height of most masonry chimneys, and resulted in an extensive collection of chimney data. Many of the results obtained apparently were contradictory. Certain chimneys, reduced to a height of 30 ft., gave the usual boiler capacity;

and others, reduced only to a height of 75 ft., showed under certain conditions of service a decrease in boiler capacity.

Altitude has an important bearing on chimney design. The error commonly made in the determination of stack capacities at high altitudes is to assume that a given grade of fuel at a fixed boiler rating will require at high altitude the same draft, measured in inches of water at the damper, as at sea level. It is evident that to develop a given boiler horsepower requires a constant weight of chimney gases and air for combustion. As the altitude is increased, the den-

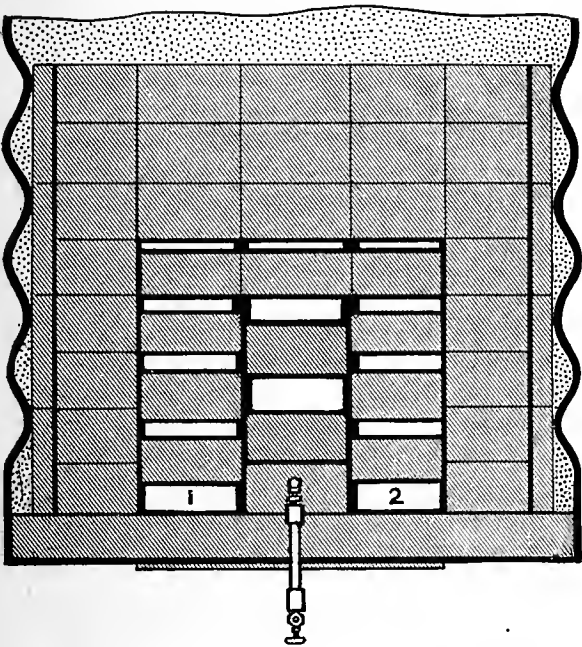


Fig. 19. Fire Brick Arrangement for Oil Burning for Scotch Marine Boiler.

sity of the air is increased, and, correspondingly, its velocity through the furnace, the bed of coal, or the fire brick checkerwork. The boiler passes must therefore, be greater at high altitude than at sea level. The mean velocity for a given boiler horsepower and constant weight of gases will be inversely proportional to the barometric pressure. And the velocity head, measured in column of external air, will be inversely proportional to the square of the barometric pressure.

For chimneys built at high altitude it is necessary to increase not only the height, but also the diameter. The increase in height causes an added frictional resistance within the chimney; this frictional loss must be compensated by a suitable increase in the diameter, and when so compensated it is evident that the chimney height must be increased at a ratio inversely proportional to the square of the normal barometric pressure.

Based on 150 per cent as the ratio of actual boiler h.p. to rated boiler h.p. and assuming sea level atmospheric pressure and 80 degrees F., the author presented the accompanying table of approximate maximum capacities measured in actual boiler h.p. These data apply to steel chimneys with short flues, the chimneys being centrally located over stationary B. & W. boilers. Other conditions are: Draft in inches at boiler outlet, chimney side of damper, 0.30; corresponding excess air through boiler, per cent, less than 50; assumed excess air supply for determining boiler

efficiency, chimney diameter and draft resistance of chimney and breeching, per cent, 50; assumed temperature of gases leaving boiler, 525 degrees F.; assumed temperature of gases entering chimney, 500

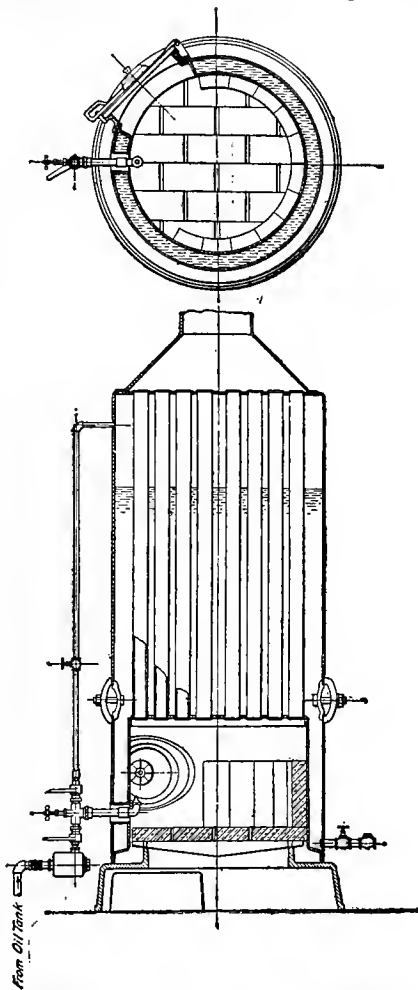


Fig. 20. Wilgus Burner Arrangement for Upright Boiler.

degrees F.; assumed boiler efficiency, working not test conditions, 73 per cent; assumed pounds of chimney gases per actual boiler h.p., 54.6:

Table of Approximate Maximum Capacities (Actual Boiler h.p.) for Oil-Burning Chimneys (Boilers 150 Per Cent Rating)											
Diam. eter, in.	Area, Sq. ft.	Height in Feet Above				Boiler-Room Floor Line.					
		80	90	100	110	120	130	140	150		
18	1.77	63	75	84	91	96	101	104	108		
21	2.41	90	108	121	131	139	146	151	156		
24	3.14	123	148	166	180	191	201	208	215		
27	3.98	161	195	219	238	253	265	276	285		
30	4.91	206	249	280	304	324	340	354	366		
33	5.94	256	310	349	381	405	426	444	459		
36	7.07	312	379	427	466	497	523	545	564		
39	8.30	376	455	514	561	599	631	657	681		
42	9.62	443	539	609	665	711	749	782	810		
45	11.05	518	630	713	779	834	879	918	952		
48	12.57	599	729	827	904	967	1,020	1,070	1,110		
54	15.90	779	951	1,080	1,180	1,270	1,340	1,400	1,460		
60	19.64	985	1,200	1,370	1,500	1,610	1,710	1,790	1,860		
66	23.76	1,220	1,490	1,700	1,860	2,000	2,120	2,220	2,310		
72	28.27	1,470	1,810	2,060	2,260	2,430	2,580	2,710	2,820		
78	33.18	1,750	2,150	2,460	2,710	2,910	3,090	3,250	3,380		
84	38.49	2,060	2,530	2,900	3,190	3,440	3,650	3,840	4,000		
90	44.18	2,390	2,950	3,370	3,720	4,010	4,260	4,480	4,670		
96	50.27	2,750	3,390	3,880	4,290	4,630	4,920	5,180	5,400		
102	56.75	3,140	3,870	4,440	4,900	5,290	5,630	5,930	6,190		
108	63.62	3,550	4,380	5,020	5,550	6,000	6,390	6,730	7,030		
114	70.88	3,990	4,920	5,650	6,250	6,760	7,200	7,590	7,930		
120	78.54	4,440	5,490	6,310	6,990	7,560	8,060	8,490	8,890		
126	86.59	4,930	6,100	7,020	7,770	8,410	8,970	9,460	9,900		
132	95.03	5,450	6,740	7,760	8,600	9,310	9,930	10,500	11,000		
138	103.90	5,990	7,420	8,530	9,460	10,300	10,900	11,600	12,000		
144	113.10	6,550	8,120	9,350	10,400	11,200	12,000	12,700	13,300		
150	122.70	7,140	8,830	10,100	11,200	12,000	12,700	13,300	13,900		
156	132.70	7,760	9,630	11,100	12,300	13,400	14,300	15,100	15,800		
162	143.20	8,410	10,400	12,000	13,400	14,700	15,700	16,600	17,400		
168	153.90	9,090	11,300	13,000	14,600	15,900	16,900	17,800	18,600		
180	176.70	10,500	13,000	15,100	16,700	18,200	19,300	20,600	21,600		

(To be continued.)

ELECTRIC DISTRIBUTION

STANDARDS IN SAN DIEGO.

Section J—Underground Construction Details.

BY L. M. KLAUBER.

[Concluded.]

The items covered are as follows:

J 10. Summary of Specifications.

J 20. Dimensions of Duct Lines.

J 30. Material for Duct Lines.

J 10. Summary of Specifications. Only a few points are here briefly covered; they are designed more to be of assistance in service work than in the more important main lines.

J 10.1. Vitrified Tile Conduit.

Tile—Vitrified salt glazed, round bore, single duct tile, 18" lengths, butt joints, 3½" bore.

Concrete—One-three-five mixture.

Mortar—One part Portland cement—2/3 sand.

Concrete Bed—3" thick, extending 3" beyond the duct.

Joints—All joints in adjacent lines to be broken.

Laying Duct—Use a standard wooden mandrel to preserve alignment and keep mortar from entering at joints. All joints to be carefully plastered with mortar before applying concrete envelope. Mortar to be at least ¼" thick.

Concrete Envelope—After laying duct, surround sides and top with a 3" concrete envelope. This envelope must not be placed until mortar has set.

Obstructions—Ducts should be laid in a straight line unless obstructions intervene, in which case long sweeping curves should be used.

Traps, Pockets and Reverse Curves—Not permitted.

Depth—Top of conduit to be at least 18" below bottom of pavement.

Grade—Shall be at least 6" per 100 feet. 1 foot per 100 feet where possible. Grade toward manholes in a straight line; if this is not possible on account of obstructions, arch or crown the line to grade toward both manholes. Grade all services toward manholes.

Plugs—Plug all ducts with wooden plugs when work is suspended.

Manhole Entrances—Where the ducts enter the manholes set back 4" from the inside face of the wall. Ends of the ducts shall be flush. Round the wall to the face of the ducts.

Rodding—Rod all ducts with an iron-shod mandrel 3½" diameter and 18" long.

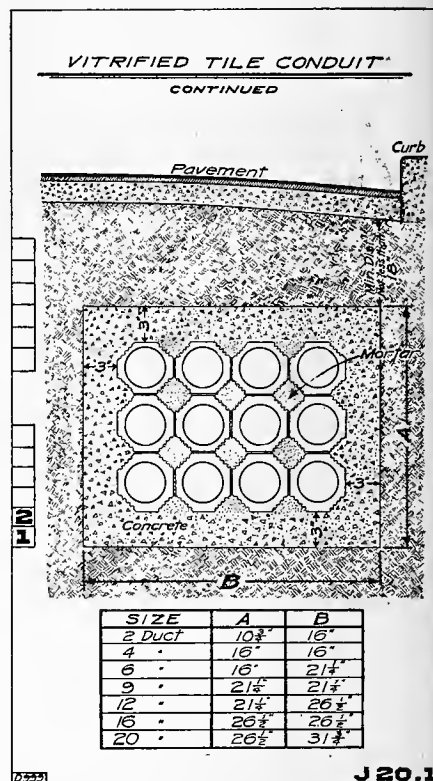
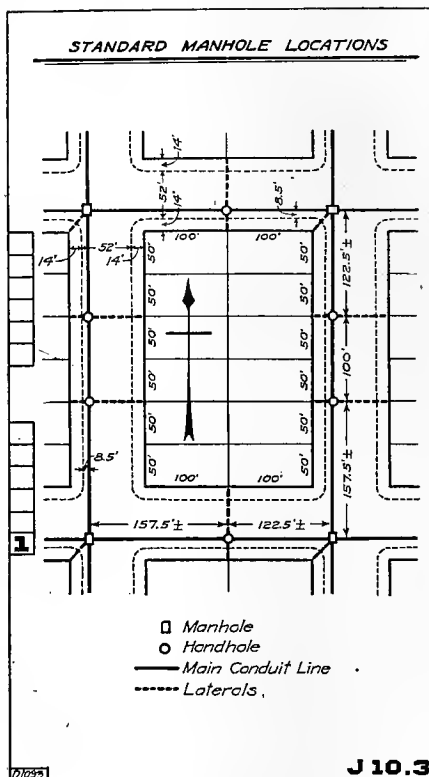
J 10.4. Note on Standard Manhole Locations.

Center line of duct line should be 8½ feet from curb line wherever possible. Manholes and handholes should in general take the positions shown unless prohibited by obstructions or unless standard positions are inadvisable, due to the special requirements of buildings or entrances. Lateral positions shown are deviated from as required by existing building services, cellars, etc. Distances given as approximate are subject to slight change, due to variations in width of sidewalks.

J 30.2. Material Required for 100 Linear Feet of Duct Line.

Size.	Concrete			Cement Mortar			Total		
	Cement, in Sacks.	Sand, Cu. Yds.	Stone, Cu. Yds.	Cement, in Sacks.	Sand, Cu. Yds.	Stone, Cu. Yds.	Cement, in Sacks.	Sand, Cu. Yds.	Stone, Cu. Yds.
2 duct.....16½	1.7	2.8	2	1.5	18½	1.85	2.8		
4 duct.....21	2.2	3.6	5	3.8	26	2.58	3.6		
6 duct.....25	2.6	4.3	10	7.1	35	3.31	4.3		
9 duct.....29	3.1	5.1	16	1.15	45	4.25	5.1		
12 duct.....33	3.5	5.8	23	1.7	56	5.2	5.8		
16 duct.....39	4.0	6.6	32	2.3	71	6.3	6.6		
20 duct.....42	4.4	7.3	40½	3.1	82½	7.5	7.3		

Above figures include an allowance of 10 per cent for waste.



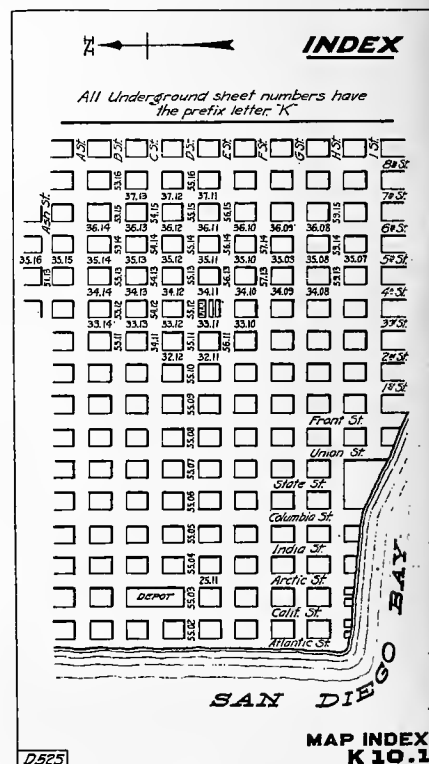
J 30.1. Concrete Mixtures—Approximate Quantities of Materials Required for 1 Cu. Yd. of Rammed Concrete.

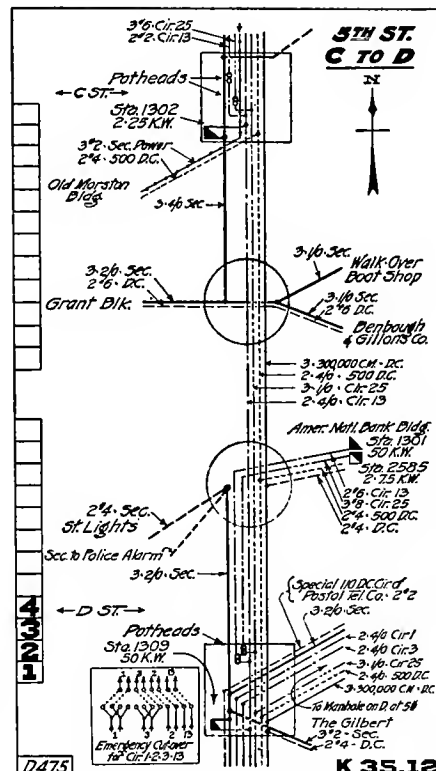
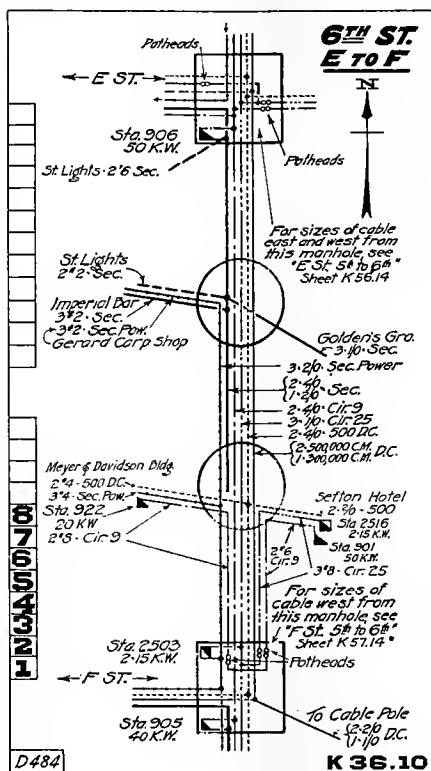
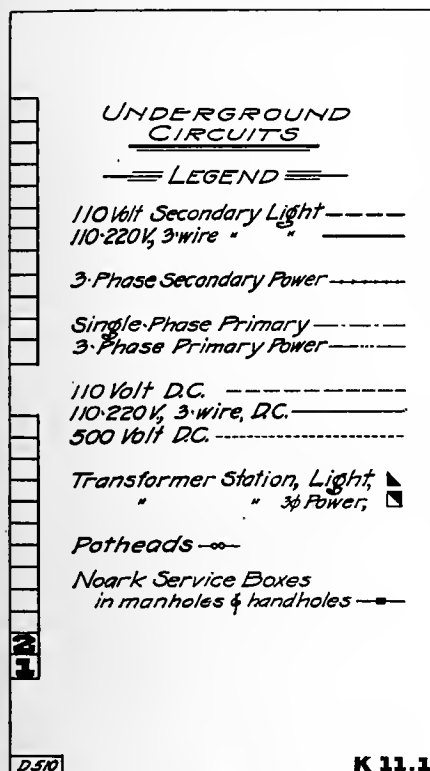
Mixture.	Cement, Sacks.	Sand, Cu. Ft.	Stone, Cu. Ft.
1-2-3	7 ¼	13.8	20.5
1-2-4	6 ¼	11.9	23.8
1-2-5	5 ½	10.5	26.5
1-2 ½-5	5 ¼	12.4	24.8
1-3-5	5	14.0	23.2
1-3-6	4 ½	12.7	25.4

1 barrel of cement = 4 bags = 3.8 cu. ft.

Approximate Weights.

	Per Cu. Ft.	Per Cu. Yd.
Cement	95 lbs.	2565 lbs.
Sand	92½ lbs.	2500 lbs.
Stone	92½ lbs.	2500 lbs.





Section K. Underground System Maps.

This section, containing about 75 sheets, is the largest in the book and the nucleus around which the balance of the book was gradually built. The matter given herein is of local interest only. However, we show cuts of the index map (K 10.1), the legend used (K 11.1) and two typical blocks; in order to illustrate the method of treatment. It will be noted that all main line and service cables are shown, together with switches, potheads, cable poles and transformers. The smaller service details and conduit sizes are not indicated, these items being kept only in the more complete office record. The treatment is entirely schematic, no dimensional data being given. As each block includes the manholes at both ends, every manhole appears in the book four times; the handholes appear once only.

This section of the book is probably the most useful of any, obviating as it does, frequent reference to the more cumbersome office records. It is likewise the most expensive to maintain, owing to the frequent changes necessitated by new construction.

In conclusion, the writer wishes to acknowledge the very great assistance received from members of the electric department of the San Diego Company in compiling the notes contained in this book. Particular acknowledgment is due Mr. Ray Cavell of the record department of the San Diego Consolidated Gas and Electric Company for the painstaking and intelligent care exercised in working out the three hundred tracings from which the handbook sheets are blue-printed.

The United Light and Power Company of San Francisco is now the subject of negotiations whereby it is expected that the Great Western Power Company will assume control.

THE OBLIGATION TO SERVE.

BY CHARLES P. CUTTEN.

(Continued.)

In Public Service Commission of Maryland v. Brooklyn & C. B. Light & Water Co., 90 Atl. 89, suit was brought to set aside an order of the commission directing the company to make certain extensions. A decision of the Court of Appeals of Maryland setting the order aside as unreasonable was made on February 25, 1914. The Brooklyn & Curtis Bay Light & Water Company held a franchise permitting them to extend their mains into the town of Brooklyn in Anne Arundel County, Maryland; but they had never extended their mains farther than within a mile of the town. The town of Brooklyn applied to the public service commission for an order directing the company to furnish water in the town; and the commission made this order, although the company claimed that it could not afford to make the extension and that such extension would be unprofitable. The case was carried to the Court of Appeals. The court, in reversing the decision of the commission, said:

There are cases to the effect that a railroad company may be required to perform a particular duty necessary for the convenience of the public, even though it may involve some pecuniary loss to the company. *Atlantic Coast Line v. N. Car. Corp.* Com. 206 U. S. 1, 27, 51 L. Ed. 933, 11 Ann. Cas. 398; *No. Pac. Ry. v. Kansas*, 216 U. S. 262, 30 Sup. Ct. 330, 54 L. Ed. 272. But we know of no case holding that a public service corporation may be required to extend its plant into territory that it has not attempted to serve when the probable revenues to be derived from such service are not sufficient to pay the interest on the cost of the extension and the maintenance of the service and is unable to sell its bonds for that purpose. Such a requirement would not only endanger the service the appellee is now rendering in Curtis Bay, but would result in disaster to the company and ultimate confiscation of its property.

The Wisconsin Railroad Commission has applied the test of reasonableness to each extension ordered

by it. In the case of Beloit Water, Gas & Electric Company v. City of Beloit, 9 W. R. C. R. 258, where the company commenced a proceeding against the city to have an ordinance of the city requiring an extension to be made, declared null and void on the ground that it was unreasonable, the commission in upholding the contention of the company uses the following language:

While it is true that a public utility is under some obligation to furnish its service to all inhabitants of a community, it is also true that the patrons are under equal obligations to meet the operating expense and provide a return upon the capital necessarily invested in the property of the utility. No utility can extend its mains or other service lines indefinitely to reach a single new consumer or a small number of new consumers and at the same time furnish service to all at the same average unit cost. It is therefore necessary either to establish some rule or rules fixing equitable terms under which extensions of its pipe or other lines will be made for new consumers beyond the limits of its system, or to make frequent readjustments of rates to all consumers to fit the changed conditions. There seems to be little if any ground on which to adopt the latter in preference to the former plan.

The Public Service Commission of Maryland seems to have adopted a similar policy. The Consolidated Gas, Electric Light & Power Company of Baltimore has made a practice of charging 70c per foot for laying gas main in excess of 100 ft. per building which would be refunded at the rate of \$70 for each additional building erected along the line of extension. The City Realty Company, owning a tract of land recently subdivided, applied to the gas company for service in a house which would require over 650 ft. of main to be laid and the company refused to do the work unless the City Realty Company would deposit the necessary 70c per ft. in excess of the first 100 ft. The Realty Company applied to the Public Service Commission for an order requiring the gas company to furnish service to the place mentioned. In giving the decision the commission says:

It seems to us that the requirements of the gas company are reasonable. The street in which the main is to be laid contains but one house which is more than 650 feet from any existing mains, and its obligations to its present customers, and the indefiniteness of the time when a reasonable return upon the outlay may be expected, and the probability that others similarly or even more remotely situated in relation to existing mains would make similar demands and injuriously affect the present service, would in our judgment, be to place an unreasonable burden upon the gas corporation.

The New Jersey Commission, in the application of the residents along Canal street in the Borough of South Bound Brook, decided in June, 1914, refused to order the extension of a gas main where the net revenue from the extension would not afford to the company an 8 per cent return. The commission said:

The item of interest at 8 per cent on the total investment involved for the service required conforms to the percentage allowance hitherto accorded as a fair allowance; and the item of \$113.80 as interest should be allowed. As remarked previously if on these marginal extensions the company were compelled to accept a lower rate than 8 per cent, adjudged hitherto as a fair rate of return, the average return would be lessened with every such extension.

In two recent decisions the California Railroad Commission has declared its position in respect to the obligation of a utility to make extensions within a municipality served by it. In the case of Vallejo

Trades & Labor Council, Complainant, vs. Vallejo Electric Light & Power Company, et al., Defendant, Decision No. 1724, decided August 12, 1914. Commissioner Edgerton said:

The attention of the manager of this company is called to the fact that its competitors have been denied entrance into the city by this commission, upon the theory that it would perform its full obligations to the public, this of course including reasonable rates, good service and proper extensions of service. Furthermore, that it has in effect a franchise to use all of the streets of the City of Vallejo and it now has a virtual monopoly. There rests upon the managers of this company the obligation to use their utmost endeavors properly to serve all the citizens of this city with electricity, of course under the rules prescribed. If these managers see fit to avoid their responsibilities and to ignore this obligation it may become incumbent upon the commission to admit competition in order that the citizens may be properly served.

In the case of Thomas Monahan vs. Pacific Gas & Electric Company, decided August 28, 1914, Commissioner Thelen said:

In so far as this question concerns extensions within the limits of incorporated cities and towns, the duty of the electric company seems to have been clearly established by the Supreme Court of the United States in the case of Russell v. Sebastian, decided on April 6, 1914. In this case, it will be remembered, the city of Los Angeles and other California municipalities claimed that by reason of the amendment of Section 19 of Article XI of the Constitution of this state, adopted on October 10, 1911, utilities using the public streets, including electric utilities, could not make further extensions without complying with such rules and regulations as the cities might under their organic laws establish. The various gas and electric companies of the state earnestly contended that this position was erroneous and that under the constitutional grant of a franchise made by Section 19 of Article XI, as it stood prior to the amendment, any such public utility which had started construction work in a city prior to October 10, 1911, had secured the right to extend its system throughout all the public streets of the city. The utilities claimed that the state's offer was an offer to grant the use of all the streets within a city and that upon the commencement of construction in any of the streets, the offer was accepted as to all the streets. This contention of the utilities was upheld by the Supreme Court. On this point, Mr. Justice Hughes, in rendering the decision, used the following language: "We think the offer was intended to be accepted in its entirety as made, and that acceptance lay in conduct committing the person accepting to the described service. The offer was made to the individual or corporation undertaking to serve the municipality, and when that service was entered upon and the individual or corporation had changed its position beyond recall, we cannot doubt that the offer was accepted. City Railway Co. vs. Citizens' R. I. Co., 166 U. S. 557; Grand Trunk Railway Co. vs. South Bend, 227 U. S., 544, 556. In this view the grant embraced the right to lay the extensions that were needed in furnishing the supply within the city."

After thus establishing the right of the utility to use all the streets of the city, Mr. Justice Hughes addresses himself to the correlative duty on the part of the utility to serve all the inhabitants. Referring to this point, Mr. Justice Hughes says:

"This construction of the constitutional provision is the only one that is compatible with the existence of the duty which it was intended, as it seems to us, that the recipient of the state's grant should assume. *The service, as has been said, was a community service.* Incident to the undertaking, in response to the state's offer was the obligation to provide facilities that were reasonably adequate (citing cases). It would not be said either that a water company or a gas company, establishing its service under the constitutional grant, could stop its mains at its pleasure and withhold its supply by refusing to extend its distributing conduits so as to meet the reasonable requirements of the

community. But this duty and the right to serve, embracing the right under the granted privilege to install the means of service, were correlative."

The rule thus established by the Supreme Court of the United States is equally sound in law and in common sense. It applies to all classes of utilities which receive a franchise authorizing them to use all the streets of a city, such as the constitutional franchise which has been granted by the state itself to all electric, gas and water companies which started construction in this state in the streets of any city prior to October 10, 1911. Each of these classes of utilities, as well as any other utility which has heretofore secured or may hereafter secure a franchise authorizing it to use all the streets of any of our California cities, is under the correlative duty of giving service to all the inhabitants of the city. While it is possible that it may be necessary in some of our cities having wide territorial extent, to modify this general rule in some respects, the present case is clearly one for the application of the general rule, I accordingly recommend that the order in this case contain a provision to the effect that the electric company shall, at its own cost, make extensions to serve all persons desiring electric service in the City of San Jose and in the other incorporated cities in the San Jose district over which this Commission has jurisdiction in this respect. The rate in this case will be established on the theory that the service is community-wide, and extensions which may be unprofitable in themselves will be taken care of in the rate so established.

I have previously indicated my dissent from the views held by Commissioner Thelen and cannot see anything in the case of *Russell v. Sebastian* which imposes a greater obligation upon utilities operating in California than exists in other states. It will be noted that in the portion of the decision quoted by Commissioner Thelen the court is careful to say that the obligation of the company is to "provide facilities that are reasonably adequate"; and again that it could not be said that "a gas company could stop its mains at its pleasure and withhold its supply by refusing to extend its distributing conduits so as to meet the reasonable requirements of the community." If the Supreme Court meant to hold that all demands for extensions within municipalities in California must be made in view of the provisions of the California constitution, whether reasonable or otherwise, the court would not have limited the obligation of the company to furnishing reasonably adequate facilities and providing distributing conduits so as to meet the reasonable requirements of the community.

What is a reasonable demand for an extension must be determined by the facts of the particular case under investigation. In my opinion it must at the same time furnish business sufficient to afford an adequate net return on the investment or be of such a character as to insure that amount of net revenue within a reasonable period of time. The fact that an adequate return is being made in one part of a city does not throw upon a company the obligation to take an unprofitable business in remote and sparsely settled portions of the same town the effect of which must be to ultimately increase the unit costs of supplying gas in the profitable section of the city.

If the reasoning of the Supreme Court in the case of *Title Guaranty & Trust Co. v. Railroad Commission of the State of California* shall be applied to a case involving the jurisdiction of the commission to compel extensions of mains within municipalities, when the question shall arise, and it shall be deter-

mined that the commission has no jurisdiction to compel extensions of facilities within cities, section 629 of the Civil Code compelling a gas company to make extensions to a distance not exceeding 100 ft. will probably be held to be a limitation upon the authority of the city as that is a general law and the authority of the city must be exercised in a manner not in conflict with general laws. In other words, the city cannot by ordinance compel extensions of mains to a greater distance than 100 ft. to serve any particular consumer. It is even questionable in view of this section 629 of the Civil Code, containing a direct expression of the legislative will in relation to extensions, whether the commission can compel extensions of more than 100 ft. to serve an applicant for gas.

From this discussion it will be apparent that the law in respect to the topic selected as the subject of this paper is very indefinite and unsettled. From the decisions, however, I think the following conclusions can fairly be deduced:

1. A gas company cannot be compelled to make extensions of its mains or facilities in territory which it does not nor has not professed to serve or held itself out as serving.

2. Neither the railroad commission nor any other body can compel a company to make an outlay for an extension, even in territory which a company professes to serve, which under the facts of the particular case would be an unreasonably large expenditure for the business to be secured. It would seem that unless the business to be secured would pay a fair net return on the investment, a court would be slow to enforce an order of a legislative body unless the case presented exceptional features.

ADVERTISING ELECTRICITY AT ROSARIO.

The Sociedad de Electricidad de Rosario, which supplies the city with electric light and power, recently opened a so-called "oficina de propaganda," or advertising office. The company has rented a large store in one of the principal business streets solely for the purpose of advertising electricity and familiarizing the public with its various applications. The company does not sell apparatus or appliances of any kind, although a great variety of articles are exhibited and explained by practical demonstration in the new branch.

The exhibit has been well prepared and charts show at a glance just what can be accomplished with a stipulated amount of current at a stipulated price by using the different appliances. Among articles exhibited are electric fans, drying apparatus, toasters, irons, curling irons, tea and coffee pots and other kitchen utensils, cigar lighters, stoves, motors for sewing machines and other household and industrial uses, etc. Electric fans and motors are already well introduced here. There is a small market for electric stoves, and when business picks up again, the activity of the Sociedad de Electricidad will probably lead to an increased demand for electric appliances of other descriptions.

The double trolley system of the Seattle municipal railways is employed to prevent electrolysis effects.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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In accordance with ancient custom, opportunity has again been offered for an expression of the gratitude we feel for blessings received.

Giving Thanks

Even the most unfortunate should feel grateful that their lot is no more deplorable than it is. How much greater cause, then, have the more fortunate for giving thanks.

Comparison stimulates thanks giving. Compared with Europe, America has every reason for giving thanks. No one is in such adverse circumstances that he cannot imagine worse. Consequently everyone has good reason for giving thanks at this season.

Mere gratitude is not sufficient. This passive sense of appreciation must be made active by expressing thanks. Nor should thanks be given in the spirit of "a lively appreciation of favors yet to come." True thanksgiving dwells only in the past.

Scientific salesmanship! It is a most alluring mouthful, scientific, because a few facts have been systematized into usable form, salesmanship, because the possessor of this information has learned how to sell a man something which

he does not want.

The order-taker, the mere clerk who sells the customer what he really wants, is no longer to be a factor in the fierce competition of modern business. The whole business world seems to have gone mad over this fetish. Verily whom the gods would destroy they first hypnotize!

Scientific salesmanship, the psychology of selling is nothing but hypnotism. The ambitious salesman can learn more from a penny pamphlet on mesmerism than from all the sales correspondence courses ever compiled—if his ambition is that of compelling his victim to buy something for which he has no use.

Dr. Boris Sodis, one of the most eminent of the psychologists, says that "the psychologist has nothing to say on the subject of advertisements, selling and business but commonplace trivialities expressed with all the pomposity of scholastic authority. . . . Psychological business claims are illusory. The sooner the practical business man learns this fact the better for him, and also for the earnest psychological investigator."

Real salesmanship must be built upon service—anticipating the consumer's need. The secret of the German commercial success was founded upon this fact. They studied their market, found what the people wanted, and then sold it to them.

The difference between selling a man what he wants and selling him what he does not want is satisfaction.

Granting that it is possible to hypnotize a person into buying what he does not want—what is to be gained? The customer is dissatisfied, a second sale is impossible, and all business must be new business.

It seems trite to say that the article to be sold must be something that the customer really wants, whether that customer be a foreign or domestic. Yet this truism has never been appreciated by the Ameri-

can manufacturer, especially in meeting the requirements of foreign buyers. A world market can not be lasting if created by the methods of hypnotic salesmanship.

As far as operators of public utilities are concerned, the principal point of interest regarding the recent elections in Oregon and Washington was the fact that both of these states voted for prohibition. Exactly what this effect will have on public utilities is hard to foresee, but one large operating company in Oregon and Washington believes its gross earnings will be reduced about 15 per cent as a result of the cessation of the liquor business. The laws do not take effect until January 1, 1916, so that some little time is left for a readjustment of business.

Election Results in the Northwest

The Oregon election also resulted in a number of other decisions on the part of the people that are of interest to engineers in general. An effort was made to pass a law that would permit the state to go beyond the present limit of indebtedness, for the purpose of building and maintaining permanent roads, and the construction of irrigation and power projects, and developing untilled lands, but it was apparent that the people at this time decided not to eliminate this limit and, as a result, the state will not be able to go into the construction business on any more extensive scale than it has in the past.

The universal eight-hour law for men and women and a specific eight-hour law and room ventilation law for women were both defeated by the Oregon voters, as well as a measure declaring the beds of all navigable waters to be the property of the state, and another measure permitting the construction of municipal wharves and docks.

One of the most unpopular measures on the ballot was the "spite" bill to abolish the present office of the State Engineer and do away with the Desert Land Board. This bill was opposed by nearly every organization of prominence in the state, and if it had passed it would have stopped all stream flow measurements, water power investigations and topographic mapping. The bill was decisively defeated, the negative vote being five to one, according to early returns. This is taken to be sufficient evidence that the people of the state are back of the present state engineer and his plans for investigation.

The constitutional amendment, initiated by the Socialist party of Oregon, providing for a department of industry of public works, the support therefor to be derived from imposing a tax of not less than 10 per cent on all estates of deceased persons, to the value of \$50,000 or over, was also defeated.

In the state of Washington, early returns indicate that the blue-sky law, convict road bill, the eight-hour bill, and a bill to provide additional first-aid-to-the-injured features to the Workmen's Compensation Act, were defeated, and in addition the bill providing for a heavy bond issue for the Quincy irrigation project also went down to defeat. As far as can be learned, the only initiative measures adopted were prohibition and the bill to prohibit private employment agencies.

The opening of the Federal reserve banks brings vividly to mind the resemblance which this new financial system bears to an electric generating system. In many respects the action of electricity is a perfect image of the action of money, which is literally as well as figuratively the power which actuates our industrial life.

The Power of Money

Imagine a great transmission network serving the diversified power needs of a wide territory. Instead of one power plant being the sole source of energy supply, there are several, so that in case of accident to any one, the pooled reserve of all the other plants is available without serious strain upon any one of them. Nor need the individual reserve capacity of any one plant be nearly as large as if it were the sole source of supply. In like manner the banks may pool their money reserves at the district Federal reserve bank, an ample central fund thus being always available without the necessity of each bank carrying a large reserve of idle capital.

The great objection to the old system was the inelasticity of the currency, its inability to expand or contract with the needs of trade. The new plan contemplates that the currency supply will be in direct proportion to the the money demand, just as in an electrical system the current supply is in direct ratio to the load demand. This is made possible by the issuance of circulating notes against commercial paper. The greater the business activity the greater the amount of commercial paper and correspondingly the more notes in circulation.

The central board at Washington supervises the doings of each district reserve bank much as the directors of a great holding company regulate the activities of its central stations throughout the country. In this way it is hoped that business activity will be stimulated that prices will be stabilized and that there will be a continuity of money supply.

The analogy between electricity and money holds in its utilization as well as in the methods of distribution just outlined. As electricity is convertible at will into light, heat or motion, so is money convertible into credit, wealth or property. In fact its value depends upon its convertibility. Changes in value are caused by economic changes, so that value is an indicating meter of economic forces.

The value of money, like the voltage of electricity, depends upon an inequality, and upon the possibility of transfer from the place of supply to the place of demand. Both act only through inequalities or difference of potential. The force of the dollar in your pocket depends wholly upon the absence of a dollar in your neighbor's pocket. If he did not want it, it would be of no use to you. Without difference of potential, electricity has no power. Likewise the power of money depends upon the elevation of one portion or the depression of another, the greater the inequality the greater the value.

Many other interesting comparisons can be cited, but enough has been said to give a clearer idea of the function of the Federal reserve bank. Yet even this, has the weakness of all analogies—absurd conclusions may be reached by following them too far.

PERSONALS

F. A. Cressey Jr., manager Modesto Gas Company, is at San Francisco.

J. B. Lippincott, consulting engineer, Los Angeles, Cal., is at San Francisco.

S. M. Kennedy, general agent Southern California Edison Company, is at San Francisco.

C. W. McKillip, Sacramento Gas & Electric Company, is a recent business visitor at San Francisco.

J. Milton Chamberlin, salesman Fobes Supply Company of Portland, Ore., was a recent visitor at San Francisco.

George C. Mason has been elected president of the Portland Association of Members of the American Society of Civil Engineers, and **John T. Whistler** as second vice-president.

C. G. Emery, formerly representative for the Hughson-Merton & Co., Inc., of Los Angeles, has recently gone in business for himself at Portland, Ore.

W. P. Naser, representative Trumbull Electrical Manufacturing Company of Chicago, Ill., has left for the East after visiting the Pacific Northwest.

F. N. Killam, formerly in charge Seattle branch of the Pacific States Electric Company, is now connected with Brooks-Follis Electric Corporation at San Francisco.

R. S. Hardy of the engineering department of the Los Angeles Gas & Electric Company, has returned to Los Angeles from a trip to San Francisco and vicinity.

S. E. Hutton was recently appointed engineer for the Public Utilities Commission of Idaho, and is now engaged in investigations bearing on light and power rate cases in northern Idaho.

C. E. Heise, Western manager Westinghouse Electric and Manufacturing Company of San Francisco, has returned from a motoring trip throughout the San Joaquin Valley in the interest of his company.

Theo. Powers, formerly manager of the Pacific Power & Light Company, Waitsburg, Washington, will join the force of the Portland, Eugene & Eastern Railway Company at Portland on January 1, 1915.

H. P. Pitts, commercial engineer with the gas department of the Pacific Gas & Electric Company, has left San Francisco to attend the convention of the National Commercial Gas Association at Minneapolis.

W. V. Clark, hydroelectric engineer of New York, left San Francisco the early part of the week to examine three proposed dam sites in the Sierra Nevada Mountains to be used for a large hydroelectric plant intended to furnish current to a project for utilizing atmospheric nitrogen.

Hammond Mathews, who has been chief electrician for the Arizona Copper Company and the Arizona & New Mexico Railroad since January, 1911, has accepted a responsible position with the Arizona Power Company and the Prescott Gas & Electric Company, with headquarters at Prescott, Arizona.

George B. Muldaur, manager field co-operation for the Society for Electrical Development, has been addressing meetings of the electrical men of the various Pacific Coast cities, including Spokane, Seattle, Portland and San Francisco, during the past month. He expects to leave San Francisco about December 1st and proceed east by way of Los Angeles.

John C. Beebe, power and pumping engineer, Idaho Irrigation Company, Ltd., Richfield, Idaho, was recently elected associate member of the A. I. E. E., also **C. A. Blair**, chief electrician Los Angeles City School District, Los Angeles, Cal.; **L. W. Hope**, superintendent, Adams Hill Corp., Eureka, Nev., and **R. A. Williams**, electrical draughtsman, Pacific Light & Power Corp., Los Angeles, Cal.

Leo Dashley and **John Dodds**, electrical engineering students at the University of Washington, Seattle, have undertaken, as a thesis for their degrees in engineering, the construction of one of the largest electrical transformers in the country. The transformer when completed will be 7 feet high, 4 feet wide and 2 feet thick, and will contain 300 pounds of wire, raising the voltage from 220 to 220,000 volts.

H. H. Trowbridge, attorney for the Southern California Edison Company of Los Angeles, is at San Francisco to handle the corporation end of litigation in connection with the absorption of utilities by a municipality. Whether a municipal corporation has the right to proceed under eminent domain, take over a utility, and operate that utility in precisely the same manner as the private corporation that preceded it, is a matter for consideration.

A. E. Drendell, president Drendell Electrical Manufacturing Company of San Francisco is an expert Nimrod as well as a manufacturer of fine switchboards. His skill, however, does not extend to oil stoves, as was made evident by a fire in his hunting lodge near Alvarado last week. After strenuous midnight endeavors he and his guests, **M. L. Scobie** and **J. A. Richmond**, succeeded in extinguishing the blaze after one end of the shack had been gutted.

MEETING NOTICES.

Utah Electric Club.

The Rev. P. A. Simpkins, familiarly known as the "Parson" by the members of the Utah Electric Club, delivered a most interesting talk before the club at its regular meeting on Thursday, November 19th, taking for his subject, "Light and Shadows of a Summer Vacation." He had planned on spending a most enjoyable vacation in his native land and for that purpose, arrived in England about the middle of July. Being a keen student of human affairs his observations of conditions obtaining just preceding and succeeding the outbreak of the great European struggle make a most interesting story. He declares industrially England is rapidly being Americanized.

Electrical Committee National Fire Protection Association.

The biennial meeting of the Electrical Committee of this Association will be held in March, 1915, in New York City. As usual, the provisions of the National Electrical Code, as they now exist will be considered, together with reports of all sub-committees. Suggestions for amendments to the Code, in order to be included in the Bulletin, must be specific and where a change is desired in a rule or section of a rule definite wording for such change must be given together with the reasons why the change is recommended and these suggestions, together with all committee reports must be in the hands of the secretary not later than January 15, 1915. As heretofore, the meeting will be open to all interested and such persons will not only be welcome, but are urged to be present and give the committee the advantage of their experience and advice.

Oregon Society Engineers.

The regular Monday luncheon of the Oregon Society of Engineers was held in the Crystal Dining Room of the Benson Hotel November 16th, with Mr. Eugene Brookings, as speaker of the day. His subject was "A Suggested Plan for Procuring More Efficient Legislation." Also Mr. Geo. B. Muldaur, manager of the field co-operation of Society for Electrical Development, gave a short talk upon the society's object and work. Mr. O. B. Coldwell, general superintendent of light and power of the P. R., L. & Power Company, was chairman of the day.

Mr. Brookings' suggestion for better legislation was the establishing of a "Legislative Reference Department" under the economic department of the State University to aid in collecting data in reference to proposed new laws and if

necessary draft them for legislators who so desire them. It is the same idea as used in Wisconsin and Indiana at the present day. This would insure better and fewer laws was his argument and avoid the declaring of so many laws unconstitutional.

The Jovian Electric League of Southern California

The weekly luncheon of the league, held at Christopher's, on November 18th, was attended by nearly 100 Jovians and a number of out-of-town guests. A splendid program was provided by D. H. Conover, who was chairman of the day. The musical features consisted of several songs by Fred C. McPherson, an accomplished baritone, and banjo selections by H. H. Crippen. Tribune Harry Pieper announced Messrs. McCutcheon and Granger as the reception committee for December, and settled once and for all, to his own satisfaction, at least, the question of whether "electrical" or "electric" should be used in connection with the word "league" by deciding in favor of "electric." He also presented to Former Tribune Jimmie Colkitt, in behalf of members of the league, a beautiful diamond-studded scarfpin, in recognition of his services. The three-minute talks, which have already become very popular with the members, were particularly witty and interesting, and were given by A. E. Morphy on the Edison Storage Battery Company, and J. Francis Rogan, Ralph B. Clapp on the F. F. Foster Co. and F. F. Foster and C. B. Hall on the Greenwood Advertising Company and J. E. Tucker.

These were followed by an instructive talk by Edwin W. Widney on "Trade Relations With South America." He pointed out that while we have but little surplus foodstuffs in excess of our demand, there are many products for which we should seek a profitable market. South America, with its 7,700,000 square miles of territory, has only 40,000,000 people, but vast natural resources, such as nitrates, copper, fruits, etc., and is blessed with abundant waterfalls, capable of being utilized for the generation of electrical energy. The United States merchants have been slow in recognizing their opportunities, and today we sell only one dollar's worth to Europe's seven dollars. He suggested that high-grade goods are wanted, that we must control more banks, learn more about the habits of the people, send experienced salesmen and develop our merchant marine. The war opens up new opportunities and the South American market is prepared to pay good prices for North American goods.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision authorizing the San Diego Consolidated Gas & Electric Company to issue \$250,000 face value of its 6 per cent debenture bonds payable December 1, 1922, and \$240,000 par value of its common capital stock. The commission's order provides that the bonds are to be sold so as to net the company not less than 23 per cent of their face value and accrued interest and that the stock shall be sold at not less than par. The proceeds are to be used for discharging or refunding obligations amounting to \$472,296.37.

The Escondido Utilities Company, operating a gas and electric system in San Diego county, has filed an amendment to its recent application, in which the commission was asked to determine the validity of a \$16,000 promissory note in favor of W. S. Sheperdson. In its amended application, the company asks that if the commission authorized the renewal of this note, or declare the present note, valid, it shall be in a sum not exceeding \$12,000 and that the company shall not be required to pay more than that amount.

The Fresno Interurban Railway Company has filed an application with the commission requesting authority to issue \$212,500 of common stock and \$350,000 of first mortgage 6 per cent 25 year bonds at not less than 80. The company also wishes authority to issue \$350,000 of 6 per cent cumulative preferred stock to be issued only when an equivalent

amount of bonds have been retired. The company proposes to use the proceeds in building a standard gauge electric railway from Fresno eastward, with a branch line to Clovis.

The Pacific Electric Railway Company has filed an application with the commission requesting authority to issue \$2,942,000 of its 50 year gold bonds, for the purpose of reimbursing itself for moneys previously expended from income for additions and betterments.

The Southern Counties Gas Company of California has filed an application with the commission requesting authority to temporarily make use of \$240,500 of notes as collateral security. The issuance of these notes was originally authorized by the commission of July 18, 1914, for a term not exceeding 3 years, at a rate of interest not to exceed 6 per cent per annum.

The Coast Valleys Gas & Electric Company has filed an application with the commission requesting authority to issue \$100,000 par value of its first mortgage 6 per cent 40 year gold bonds. It proposes to use the proceeds in reimbursing itself for moneys expended from income or borrowed money for additions and betterments to its system, amounting to \$69,392.43. It is proposed to use the balance for further construction work.

NEWS OF OREGON RAILROAD COMMISSION.

The commission will hold a hearing at Salem on November 27 in the matter of the local, long distance and toll rates, charges and regulations of the Pacific Telephone & Telegraph Company in Oregon, regarding which a thorough investigation has been held on the commission's own motion.

The commission has authorized the Interurban Telephone Company of Silverton to increase its rates for various classes of service to an amount approximating 15 cents per month in excess of rates which have been charged in the past.

Upon the complaint of the City of Dallas the commission has ordered H. V. Gates to re-classify its consumers and serve them at lower rates.

NEWS OF IDAHO PUBLIC UTILITIES COMMISSION.

The commission handed down decisions on Saturday, November 7th reaffirming the determination of the commission not to grant certificates of public necessity and convenience to companies to enter a field which is being adequately served by the existing company. The decisions rendered had reference to the application of the Idaho Power & Light Company and the Clear Lake Power & Improvement Company to enter the field now supplied by the Great Shoshone & Twin Falls Water Power Company in the counties of Twin Falls, Gooding and Lincoln. Territory which is the goal of the two petitioning companies is that of the cities of Twin Falls and Buhl and the villages of Wendell and Filer and the country immediately contiguous. Franchises in these towns and villages were secured by the Idaho Power & Light Company between the time the public utilities act went into effect and the time it was enacted.

This company sets forth in its complaint that it has a power site on the Malad River which is most favorable for the development of electric power; that it has fulfilled the terms of its contract up to the present time, and that it now wishes to complete its arrangements with the state by completing the power plant at the Malad River. It avers that it is unable to do this with only the territory which it serves at the present time, but that it must have that in Twin Falls, Gooding and Lincoln counties.

It claims that the present rates and service of the Great Shoshone Company in that field are not such as can be furnished by the Idaho Power & Light Company and that they are not approved by the sentiment of the territory served.

These same allegations are made by the Clear Lake Company, which has a power site a short distance from Gooding and Twin Falls. For this reason both petitions are taken up together.

More than 30 pages of manuscript are used in explaining the reasons for the decision against the two applicant companies. In addition to summarizing the applications of the two companies, one of which, that of the Idaho Power & Light Company, relates the whole history of the company, the order comments on a part of the oral testimony offered and makes a lengthy defense of its usefulness and of the advantages of regulation over competition. Not only does the commission go into all these matters thoroughly, but it recites the circumstances of the previous troubles of the Great Shoshone and Idaho Power & Light Company.

The Idaho Power & Light Company began construction of its lines into the city of Twin Falls on April 29, 1913. The Great Shoshone Company complained to the commission that its rival was attempting to operate without a certificate of public necessity. The Idaho Power Company answered that it was building under the provisions of the law which provides that a public utility under certain conditions may complete any work under any permit or franchise already granted.

Such contention was ruled against by the commission and later, upon appeal by the supreme court which, in handing down its opinion in the case, upheld the constitutionality of the utilities act. This court decision is made the basis for much of the commission's holdings in the order.

In answering the propositions involved in a study of any field in such a case as the commission has before it, the commission finds that the present supply of electrical energy furnished by the Great Shoshone Company is sufficient for the needs of the territory which it controls; in constructing its works, it has planned for the future and is able to care for the needs of the territory when further demands of the country are made.

As to whether the company has discharged its duties toward the public by giving efficient service, the commission finds that many of the complaints are unjust in that they apply to the failure of the company to furnish current for heating buildings at the beginning of the season of 1913.

This service, the commission finds, is not a legitimate or justifiable use of electricity and should not be blamed to the company for the further reason that because of the Kuhn failure, it was unable at the time to acquire the machinery necessary for furnishing this current. The commission also finds that many of the complaints are unreasonable and that the service asked is disproportionate to the revenue which would be obtained.

A commendable effort has been made to serve the community, the commission finds, by the extension of the Great Shoshone Company of its lines into small villages and communities, expensive to reach.

That the Idaho Power & Light Company can furnish power to the territory in controversy at a cheaper rate than can the present company, the commission doubts. It seems no advantage of position and finds no relief from the figures that have been presented.

As a further reason for denying the rights of the petitioning companies to enter the field, the commission says that it can see no way to prevent the invading companies from taking the cream and leaving the milk for the old company. That is, it explains, that the new company could easily take the patronage away from the more profitable communities where the larger company depends for its profit and leave only the smaller ones which are less profitable.

Finding then, no point where the Great Shoshone Company has failed to supply its territory satisfactorily, the commission refuses to let either the Idaho Power & Light Company or the Clear Lake Power & Improvement Company invade its field.

In answer to the petition of the Beaver River Power Company to be allowed to compete with the Southern Idaho Power Company for the business of Pocatello, the public util-

ities commission in an order issued recently says: "The existing company is the pioneer company in the field and has served the same for a great many years in perhaps as satisfactory manner if not better than the average utility of like character doing business in the state of Idaho and we can see no reason why, with its superior location and other facilities it cannot furnish sufficient service at as cheap a rate as any water company in the state, and we are not convinced that the applicant company has any superior facilities or is more favorably situated for improving the service and at the same time reducing the rates than is the existing company."

Testimony was taken, an investigation made and argument heard on the matter at the same time as the commission investigated the Idaho-Oregon Light & Power Company's petition to enter the field of Twin Falls, Gooding and Lincoln counties.

Taking the load factor into consideration, the public utilities commission fails to find any discrimination between the rates charged the Marsh Mining Company and other companies furnished with power by the Washington Water Power Company. By an order handed down November 6th in the case, the commission denies the petition of the mining company to compel the company to make its rates such as to conform with the ideas of the mining company.

As the case is stated in the complaint, the Marsh Mining Company is served at its mine at Burke, and at its concentrating plant at Monarch. It paid for the service under contract until April 11, 1913, and by oral agreement continued to take the service and pay for it on the basis of the price fixed in the contract until January 1, 1914. The price paid up to this time is stated in the complaint to have been at the rate of 11.3 mills per kilowatt hour.

During this time, the mining company avers, the Bunker Hill Mining Company, the Federal Mining Company and some others in the same district with the Marsh Company paid but 8 mills per kilowatt hour. Upon finding this to be the case, the Marsh Company refused to pay at the basis of the contract further, but demanded a rate of 8 mills per kilowatt hour. The power company refused this rate and threatened to shut off the power.

The mining company secured an order from the commission enjoining the power company from discontinuing its service to the Marsh Mining Company until an investigation could be made of the rates of the Washington Water Power Company in the state of Idaho.

In its answer to the allegations of the mining company, the power company explains that its contracts with all of its companies are in the same form. It explains that the seeming discrimination against the Marsh Mining Company is not a real one, because the mining company fails to take into consideration its load factor, upon which all the charges and contracts made by the Washington Water Power Company for such service are based. By means of oral testimony and charts, the agents of the company made further representations along this same line. A clause in a contract with the Hecla Mining Company, the property of which adjoins the property of the Marsh Mining Company was also explained at this time.

The complaint of the Marsh Mining Company brought out the fact that the Hecla Mining Company had a contract guaranteeing that its rate should not be in excess of 8 mills per kilowatt hour. The explanation was to the effect that the load factor of the Hecla Company was known and that this company had put in a hoist which has been recommended by the power company. The power company, in order to insure its good faith, gave the company a guarantee that, by use of the new machine, the cost for power would not be materially increased.

Explaining that apparent discriminations of this and other kinds may be shown not to be so by an equalization of

conditions causing them, the public utilities commission decides that there is no reason to believe that the Marsh Mining Company has suffered through the rates of the power company favoring other companies.

This decision, however, the commission is careful to say, has no bearing on the reasonableness or unreasonableness of any rates charged by the Washington Water Power Company, except as they may be discriminatory in this instance. There is pending before the commission at this time an investigation into these rates and certain rates which the commission deems fair and equitable to consumers and company alike, have been put into effect pending the conclusion of the investigation and the hearing upon it.

TRADE NOTES.

Habirshaw Wire Company has transferred its sales office to its works at Yonkers, New York.

Allis-Chalmers Manufacturing Company has been awarded the contract for building the new sub-station at Smith's cove, Seattle, by the port commission at \$5760.

Hunt, Mirk & Company, representing the Westinghouse Machine Company, have moved their Seattle office from 909 Alaska building to 1407 same building.

California Electric Supply Company, 643 Mission street, San Francisco, has recently made arrangements to carry a stock of Economy renewable cartridge fuses.

The Clingan Construction Company, Hinckley building, Seattle, is constructing an addition to the power house of the Alaska Treadwell Gold Mining Company, Treadwell, Alaska. The work calls for 200 tons of structural iron and two stacks.

The Northwest Advertising Company has been organized by I. W. Dudley, R. W. Nevin, et al., with factory at Howard avenue north and Aloha street, Seattle, and temporary headquarters at 501 Hoge building. The concern is incorporated for \$100,000 and it is stated that an assembling plant and general headquarters will be established here. The chief article of manufacture will be an electric device which is being installed on the municipal street car lines and which will automatically flash the name of each street intersection before it is reached by the street car.

NEW CATALOGUES.

Electrical House Goods is the subject of a comprehensive catalogue of electrical supplies manufactured by Edwards & Company, of New York City.

The Century Electric Company is distributing an attractive folder entitled "Relief at Last," illustrating and describing the 1/6 h.p. Century alternating current motor.

The Edison Storage Battery Company is distributing a valuable bulletin presenting a concise description in non-technical language regarding the Edison battery. Its construction is illustrated and described and its many applications are listed. Detailed instructions are given for the operation and care of batteries and engineering reference tables are shown on individual cell characteristics.

"Light and Your Eyes" is the title of a compact little treatise on the subject of the effect of illumination on the eye, just issued by the Cooper Hewitt Electric Company. This pamphlet contains a lot of information on this most important subject, written for the benefit of the workman. The subjects of the best kind of light for work, glare, and effect of red and blue rays on the eyes are discussed in a practical manner. "What Users of Cooper Hewitt Light Say About It," is the title of another folder just issued by this company in which some interesting experiences are given by the users of Cooper Hewitt light. A number of points are brought out particularly with reference to the preference of workmen for this form of illumination, after having overcome the initial prejudice held by some users of this light.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell, Secretary-Treasurer, 814 Scott, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correlate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

BY THE SECRETARY.

Section Meeting.

The association will hold its regular meeting November 28th at City Hall, Berkeley. We are now prepared for the winter campaign to further our unchangeable object: "To secure a better and more uniform standard of electrical construction, to promote uniform interpretation of the rules which comprise the standard, and to disseminate information and correct practice among our members"; but we will now bring up our heavy artillery and conduct a more vigorous battle instead of the trench fight we have hitherto been pursuing. The subject for this meeting will be "Proposed Changes in the N. E. Code."

Code Committee.

Of great interest to those engaged in the electrical inspection service will be a meeting next March of the Code Committee, National Fire Protection Association. With this committee rests the responsibility of keeping the code abreast with the times, both with regard to installation rules and specifications for the construction of electrical fittings and material. The parent body, the National Fire Protection Association, is composed of many organizations, and is, in short, a clearing house, as far as data on safe construction is concerned, for every institution of consequence on the continent interested in the prevention of fire. Its executive department, so far as electrical affairs are concerned, is this Code Committee.

Refillable Fuses.

One subject which will in all probability receive due consideration from the Code Committee will be refillable fuses. Makers of fuses have for the past few years been placing on the market several types of refillable cartridge fuses. Some of these fuses submitted to the underwriters' laboratories for test and criticism have successfully withstood all tests imposed upon them, though, of course, could not be classed as approved devices. The code on this point provides that the case and terminals of the device shall be so constructed that it will be difficult to replace the fusible element when melted.

The chief feature of the refillable type of fuse is the accessibility of the fusible element. Enclosed fuses can be, and in many cases are, reinforced with wire placed inside the case in a manner which will deceive the most careful observer. Sometimes the reinforcing wire is almost as large as the conductor it is presumed to protect. There is no feasible way to determine the contents of an enclosed fuse except to cut open the case, and this the inspector is reticent to do. With the refillable or accessible fuse this difficulty is in a great measure overcome; but the fuses should be so constructed that it will be difficult to refill them except with elements designed for the purpose, and so that it will be cheaper to refill them properly than improperly.



INDUSTRIAL



A MOTOR ON THE WATER WAGON.

"What is the motor doing on the sprinkling cart?" is the question every one asks when they see the accompanying picture. It obviously does not run the wagon, so that its use is somewhat problematical.

As a matter of fact, this cart is specially designed to meet conditions found in many well-irrigated districts, as around Salt Lake City where the photograph was taken. The cart does not obtain its supply from a fire plug, in the ordinary way, but from irrigating ditches outside the city.

Points are provided at frequent intervals along the ditches where the driver can plug the motor on to a power



Water Sprinkler Equipped With Motor Driven Pump.

line. The motor then drives the centrifugal pump, also mounted on the rear of the cart, and fills up the tank.

The application is a severe one, as the motor is subjected to considerable dust and jolting but it has operated with entire satisfaction.

The cart is made by the Studebaker Corporation, South Bend, Ind. The motor is a 3 h.p., 1740 r.p.m. single-phase Westinghouse Electric and the pump a 1½ in. type C Worthington.

THE PETERSON OIL FILTER.

Theo. F. Dredge, San Francisco representative of the Richardson-Phenix Company of Milwaukee, has received results of tests at Cornell University which show that oil filtered through the Peterson oil filter can be used over and over again indefinitely without losing its lubricating qualities. The filter is provided with a coil which heats the oil so that water and heavy foreign particles are precipitated while passing over a series of baffle trays. The oil is afterwards filtered and ready for use. This device is applied to turbines as well as to engines and can be adopted for filtering transformer oil. Single units have a capacity of from 100 to 200 gallons per hour, and may be combined into multiple filters of two or three units each with corresponding increase in capacity.

\$AV-R AUTOMATIC ELECTRIC STEAM OVEN.

The Berkeley Electric Cooker Company, Berkeley, California are placing on the market an Automatic Electric Steam Oven, known as the \$av-R Steam Oven. Its use is claimed to be cheaper than coal, gas or wood, furthermore it is a saver in food values, in weight of roast meats, and eliminates burning and the constant watching necessary in other stoves. It is clean, convenient and compact and gives no dirt or ashes.

The oven is cylindrical in shape, enclosing a copper receptacle for aluminum vessels. This cylinder is thoroughly insulated and the copper receptacle consists of two copper



Automatic Electric Steam Oven

jackets, electrically welded, containing a quantity of water and a hollow space, from which the air has been drawn, leaving a vacuum. When the current is applied the water is converted into steam at a temperature of about 60 degrees C.

Current is not used continuously, as when the temperature reaches a certain point the steam controlled automatic device turns off the current, and when the temperature falls below a certain point turns the current on again, thus rendering it impossible to burn the most delicate food.

This steam fills the entire enclosure surrounding the cooking vessels, but does not come in contact with them, thus performing its function of cooking the contents without the possibility of burning or scorching them. All of the mechanism is concealed and no special wiring is needed, as this is a lamp socket device. The oven has four compartments for food, all to be cooked at the same time.

A novel and useful feature applied with the \$av-R Steam Oven is the time switching device, which will start the cooking at any time desired.



NEWS NOTES



FINANCIAL.

VANCOUVER, WASH.—The Yaquina Bay Electric Company, with headquarters here, has voted to increase its capital stock from \$20,000 to \$40,000.

SACRAMENTO, CAL.—The M. Noonan Company of Springfield, Mass., manufacturer of water pipes, is anxious to take over the entire water mains bond issue of \$1,329,000. The United States Cast Iron Pipe Company is likewise anxious to take over the issue, both companies being desirous of disposing of water pipe.

BRIGHAM CITY, UTAH.—The county commissioners of Boxelder county have decided to purchase the electric light bonds of the town of Mantua. At the board meeting held here this week County Attorney W. J. Lowe appeared on behalf of the Mantua town board and presented a resolution from that board regarding the sale of bonds in the sum of \$3000. The commissioners approved the Mantua resolution and then passed a resolution for the purchase of the bonds. The people of Mantua contemplate the installation of an electric lighting system, for which the proceeds of the bond issue will be used. Power will be purchased from Brigham City.

ILLUMINATION.

SEATTLE, WASH.—Property owners on Magnolia bluff have requested extension of city lighting in this district.

RIDGEFIELD, WASH.—Bratlie-McClelland Shingle Mill Company has applied to the council for an electric light franchise.

MONTESANO, WASH.—Louis Burnett has under consideration sites for gas plant for which they recently secured franchise.

TUCSON, ARIZ.—Bond issues totaling \$239,000, and including a street lighting issue, will be submitted to voters at the city election December 14th.

MALAD CITY, IDAHO.—The Evans Light Company is busily engaged in the installation of a light plant which will be ready for operation about December 1.

SEATTLE, WASH.—The Pacific Power & Light Company has just completed the installation of the waterwheel for its new power plant in the Naches district, Washington.

LOS ANGELES, CAL.—An election has been called for December 3, when an order for the dissolution of the Miramonte and Florence Lighting District will be voted upon.

SEQUIN, WASH.—The council has granted an electric light and power franchise to J. L. Keeler, and a committee has been appointed to arrange for street lighting during the coming year.

GREAT FALLS, MONT.—The Malta Lighting Company of this city has started the erection of a new reinforced concrete power plant to furnish electricity for power and illumination purposes.

TACOMA, WASH.—The city council has provided for the installation of a system of street lighting, consisting of metal standards at alley corners and approximately the same spacing in the blocks.

LOS ANGELES, CAL.—Sealed bids will be received by the board of supervisors of Los Angeles county up to December 14th for furnishing electricity and maintaining lights in the Newhall Lighting District.

WINNEMUCCA, NEV.—The Board of County Commissioners has set December 7th for hearing the application of

W. J. Compton and Frank L. Reber for a franchise to operate a gas plant here.

SPOKANE, WASH.—Steps have been taken for the lighting of Sprague avenue from Division to Cedar street, and Trent avenue from Division to Lincoln street, with artistic electroliers, which it is estimated will cost \$110,000.

RIVERSIDE, CAL.—The board of utilities has awarded a contract to the General Electric Company for street lamps and lights for houses. The contract calls for a minimum purchase on the part of the city of lamps to the value of \$5000.

WHITTIER, CAL.—President Bain of the Southern Counties Gas Company, has given his word that Whittier is to be included in the cities to be supplied with natural gas. It is probable that pipe line will be extended from Whittier Narrows to Monrovia, where the company has a franchise also.

RIVERSIDE, CAL.—Representatives of the General Electric Company, Westinghouse Lamp Company and the Edison Lamp Works, were before the board last week to bid on the annual contract for supplying the city with electric lamps. The matter was laid over until next meeting for further consideration.

SAN FRANCISCO, CAL.—Supervisor Payot suggested at a recent board meeting that the Municipal Railway fund be drawn on for lamps, brackets, etc., for lighting Van Ness avenue, the cost being estimated at \$28,000. It was planned to attach the lights to the railway trolley poles. The committee did not approve using the fund for this purpose.

FRESNO, CAL.—Work has been started on a generator house at the local gas works. The house will be of sheet iron and will cost \$2000. One of the gas machines, which now stands in the open, will be placed in the new building. The trustees has authorized the street superintendent to issue a blanket permit to the Pacific Gas & Electric Company to dig 250 holes in paved streets in various sections of the city for the purpose of killing old service connections which are causing excessive leakage and destroying trees and grass. The work will be done at the expense of the corporation and will cost more than \$3000.

LOS ANGELES, CAL.—The city council has approved a resolution providing for the condemnation of the plant and distribution system of the Southern California Edison Company in order that it may be used to serve power from the Los Angeles aqueduct to city consumers. The Railroad Commission will be asked to evaluate the property. The cost of taking over the system will be paid out of the \$6,500,000 power bond issue voted by the people a year ago. The bonds still are unsold.

SAN JACINTO, CAL.—The Southern Sierras Power Company has entered into a contract with the City of Hemet whereby a series tungsten street lighting system will be installed at once. The contract provides for brackets and center suspension type fixtures, complete with lamp and shade. Current to supply this contract will be received from the company's five large hydro-electric plants at Bishop, Cal. Contract was negotiated by and between the trustees of the City of Hemet and R. B. Mateer, superintendent of the San Jacinto-Hemet-Winchester-Lake View District.

SALT LAKE CITY, UTAH.—The officials of the Utah Light & Traction Company have offered to grant substantial reductions in the rates charged for electricity for lighting and power purposes in Salt Lake City in consideration of the city commission granting them the permission to consolidate the franchise granted to the Merchants Light & Power

Company with the franchise granted to the Utah Light & Railway Company, both of which have been acquired by the Utah Light & Traction Company. The company offers to reduce the retail lighting rates from 10c to 9c for the first 250 kilowatt hours, and from 9c to 8c for the second 250 kilowatt hours. They propose also to reduce the price charged for flat rate arc lamps from \$5.55 per month, \$6.67 per month, and \$11.11 per month for 10 p.m., midnight and all-night service respectively to \$4.00, \$5.00 and \$8.00 per month respectively. The company proposes to reduce the base rate on direct current from 11c to 9c for the first 100 kilowatt hours used per month, and the base rate on alternating current which is the kind of energy most generally used in Salt Lake City from 10c per kilowatt hour to 8c per kilowatt hour for the first 100 kilowatt hours used per month. The commission and the company officials have agreed on the major portion of the proposed changes and the minor details are being worked out and it is expected that a decision will be reached in the near future.

TRANSMISSION.

ASHTON, IDAHO.—A contract has been awarded to Malcolm & Larson for the construction of a large concrete dam for the Ashton-St. Anthony Power Company; \$54,000 is the amount of the bid.

AUBURN, CAL.—In order to comply with a state law, which compels power companies to ground all 60,000 volt insulators, the Pacific Gas & Electric Company had the necessary work done in this section.

ASTORIA, ORE.—The Pacific Power & Light Company is locating a line for power to Warrenton, Hammond and Flavel, so that the matter can be submitted to the county court and the construction started.

WEAVERVILLE, CAL.—The California-Oregon Power Company has applied for a franchise to erect poles, etc., for transmitting electricity in Trinity county. Sealed bids for the sale of such franchise will be received up to January 7th.

ARLINGTON, WASH.—The Jim Creek Water, Light & Power Company has requested the Snohomish county commissioners to fix a date for hearing an application for franchise to operate electrical power lines along certain county roads.

LOS ANGELES, CAL.—An ordinance has been passed creating a conduit district within this city and prohibiting the maintenance of wires and poles for the transmission of electrical energy within the district, which includes all portion of Los Angeles street, between Alameda street and the southerly line of Plaza street.

PORT ANGELES, WASH.—The Olympic Power Company is installing at its Bremerton substation a 500 k.v.a. synchronous condenser, which is direct connected to a synchronous booster. This is designed especially to give voltage regulation to both the Bremerton distribution lines and the lines feeding the Puget Sound navy yard.

OGDEN, UTAH.—The Grand Canyon Canal & Power Company has been incorporated to develop power of John Day's River in eastern Idaho and western Wyoming. The purpose of the company is to enter into general hydro-electric power business, to build electric transmission lines, irrigation canals, to operate electric plants and develop mine and oil and timber holdings. H. J. Craven, Ogden, is among the incorporators.

TRANSPORTATION.

SAN FRANCISCO, CAL.—Bids are being taken by the board of works for steel rails, rail joints and fastenings for the Seventeenth street car barn.

SAN FRANCISCO, CAL.—The board of works will receive sealed bids until December 2d for the construction of the California street line of the municipal railway system. Bids must be on forms furnished by the city engineer.

LEWISTON, IDAHO.—The state highway board has voted approval of a franchise to A. G. Nortz, Lewistown, for a street car line across the inter-state Lewistown-Clarkston bridge. The car line is to be in operation by September 1, 1915.

SEATTLE, WASH.—The Chicago, Milwaukee & St. Paul Railroad Company announces that preparatory work is to be started at once for continuing the electrification of its Puget Sound extension between Avery, Idaho and Harlowtown, Montana, a main line distance of 440 miles.

TUCSON, ARIZ.—A new franchise for the Tucson Rapid Transit Company will be voted on at the city election to be held December 14th. The new franchise is for 25 years and had been requested by the company to allow it to build a new line on Main street, to Pastime Park and Speedway.

FRESNO, CAL.—C. O. Whittemore, who has been associated with Senator Clark on the Salt Lake line and was vice-president and general counsel of the Clarke roads in Nevada, has become associated with John B. Rogers and the Mahoney Bros., in the construction of the interurban out of Fresno.

CALDWELL, IDAHO.—A movement has been inaugurated by the Caldwell Commercial Club to secure the electrification of the Wilder branch of the Oregon Short Line, extending from Caldwell to Wilder, a distance of approximately 11 miles. It is understood that the Short Line is willing to lease the property for a long term of years to responsible parties and an effort will be made by the Caldwell, Wilder, Greenleaf and Homedale commercial organizations to interest the Caldwell Traction Company in the plan. The local organization appointed a committee of three, Messrs. J. H. Lowell of Roswell, I. S. Binford and B. M. Holt of Caldwell to investigate the plan and to co-operate with the committees to be appointed by the other organizations.

SAN FRANCISCO, CAL.—The supervisors' committee on public utilities last week listened to a committee representing the district improvement clubs, which asked that immediate arrangements be made for routing cars of the United Railroads over the Municipal tracks to the Exposition grounds next year. It was agreed that the proposed general exchange of transfers between Municipal Railway and the United Railroads during the Exposition would not be practicable, and this proposition was dropped. Mayor Rolph approved the request of improvement clubs to run the Stockton Street Municipal Railway cars over the Fourth street tracks of the United Railroads to or beyond the Southern Pacific depot. The utilities committee chairman stated that conferences with the United Railroads officers were being had on the subject.

TELEPHONE AND TELEGRAPH.

SAN FRANCISCO, CAL.—The new telephone directory shows a total of 174,310 telephones in the bay counties, a decrease of over 7000 since June.

CHANDLER, ARIZ.—C. Oakes, foreman of the Mountain States Telephone Company, inspected the Chandler lines recently, preparatory to starting work of remodeling and improving the present system.

FRESNO, CAL.—In order to maintain better service and to take care of the increasing business, three new sections of switching boards are being installed in the local office of the Pacific Telephone & Telegraph Company. The work of installation will not be completed until February 15, 1915. Another change that will be made in the office to better the long distance service between Fresno and San Francisco and way stations, will be to have all long distance calls come directly into the local operators and they will connect with the party being called here. This will do away with the delay caused by the call going through the local long distance operator. Long distance calls being placed in Fresno will be handled the same as in the past.

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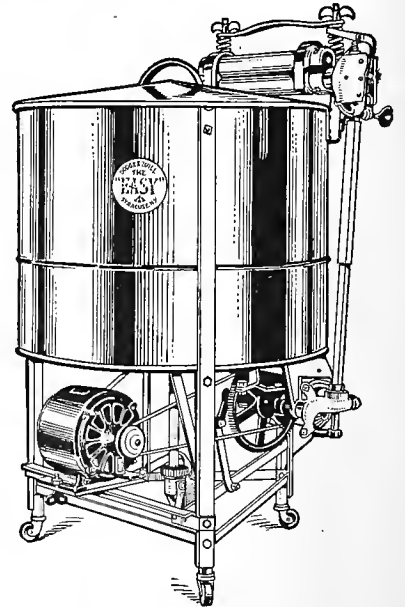
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ARCH ILLUMINATION AT PORTLAND

BY C. C. CRAIG.

A few of the merchants on Third street in Portland, Oregon, realizing that their business was drifting further up town, recently called a meeting for the purpose of devising ways and means of retaining their trade. The Northwestern Electric Company was called upon to submit some unique method of street

A special cable for lighting these arches was pulled from the central station and is controlled by a switch in the power house. The lights are distributed as follows:

Two 40 watt Mazda lamps contained in the globes on each column and one 750 watt nitrogen filled lamp



Arch Illumination at Portland.

illumination, with the result as shown in the illustration.

These archways are constructed of steel of four angle irons, boxed and latticed together, all the angles and lattice bars being riveted. The legs of the arches were made up into two sections each and completely manufactured in the shop and set up on the street by derricks. The arches extend to and rest upon a steel bed plate set in the concrete work in the sidewalk. The size of the steel legs are 12 by 18 in. The concrete casing which surrounds the bases of the arches and forms the columns, were cast in a mold of concrete set in place, smoothly finished, well rubbed and primed, and painted the same color as the steel work—being a light gray.

in the central globe; the arches are outlined in 40 watt lamps, 48 outlets to the half arch or 192 outlining lamps to the arch.

The results obtained from the illumination were highly satisfactory to the merchants—the street being beautifully illuminated. On the day of the formal opening, the merchants secured double pages in the daily papers in which they all placed their advertisements and in the center a program announcing the hour of the illumination. That evening at various intersections along the street they had provided bands of music and although it was raining, the crowds that gathered long before the time for turning on the lights was so dense that the police had difficulty in handling them.

WHAT'S WRONG WITH MUNICIPAL OWNERSHIP?

BY CHAS. A. WARNER.

(This article presents a succinct analysis of the weak points in municipal ownership and some suggested remedies therefor. It is condensed from a paper presented at the Third Annual Conference of the League of Northwest Municipalities, Seattle, November 12, 1914.—The Editor.)

From the title of my paper it may be that some will anticipate an attack on the whole subject of municipal ownership. Yet that is not my purpose. I am not opposed to municipal ownership. In fact, I have a clear record in advocacy of clean, efficient, honest public ownership, as well as in constructive criticism of the other kind of public ownership.

One of the greatest deterrents to the right kind of municipal ownership is the way in which beneficiaries of the wrong kind of municipal ownership endeavor to confuse the public mind by condemning every one who honestly criticizes their methods.

During approximately 30 years in which what are now called public utilities have developed out of the imaginations of a few men, who were at first classed as dreamers, the world has seen a great many changes in the public point of view toward these utilities.

At first, no one paid any attention to the efforts of those who were trying to introduce new methods of light, heat, power, transportation and communication. These men were called "promoters" and as a rule, experienced considerable difficulty in getting either the public or the financial men to take their proposal seriously.

As the enterprises promoted by these pioneers of public utility evolution developed into established business institutions they were regarded just as any other line of business would be, as classes of private business destined to succeed or fail according to whether they were able to successfully meet natural competition. In the early days, any one who would have referred to an electric light business as a proper matter for municipal ownership and operation would have been derided.

The changes of public opinion or sentiment are hard to understand. One would naturally suppose that the public would be most concerned with those things which are necessary to human existence and that the degree of public concern would be proportionate to the extent to which things relate to preservation of life and health. Air, water, food, clothing, shelter, sanitation, police protection and fire protection are about in the proper order of importance in this respect. No one will seriously contend for a minute that electric light is a necessity and yet this is the one kind of business into which more municipalities have entered than any other aside from water, sewage, police and fire protection which are necessities. Why was such a luxury as electric light chosen as a field for municipal operation and not the grocery business which deals in necessities? I have asked this question of many men and have received many answers. The common answer is that the electric light business depends on the use of the streets and is therefore a natural monopoly and should be owned and operated by the city. Well, suppose we agree that the electric light business is a natural monopoly. Is it any more

a natural monopoly than sugar or oil for example? From the same point of view all lines of commerce and industry are natural monopolies and if we apply the same procedure in each case we shall have applied socialism with all its blessings.

It is also stated that public utility profits have been enormous and that it is necessary that these utilities be taken over and operated by the public in order to prevent a few holders of public utility securities from amassing profits so enormous that those security holders will become unduly powerful and constitute a menace to individual freedom.

It may be that some of the companies during the period of transition from the experimental to the successful operating stage of public utilities, made large profits. If so, I hardly think fair men will begrudge them even extraordinary profits, considering the risks taken and the ability and energy necessary to development of successful institutions out of a bare set of conditions. Certainly many companies did not make even a fair rate of income, and I doubt, if on the average, income has been in proportion to the other elements involved. On the other hand look at the enormous fortunes that have been amassed in merchandising, and in financial, mineral and industrial pursuits. Some of these, as before stated, have a much closer relation to public welfare than the so-called utilities and they have certainly shown greater profits with less risk attached to the money invested. Many such institutions have been built up on a small investment, entirely out of the profits of the business. No public utility could do this. All men of practical experience in operating public utilities, know that the greater the business, the more bonds must be issued to pay for extensions to handle the business, so that an important factor in successful management of public utilities has been and is the borrowing of money. I remember talking with an official of a large telephone company a few years ago. The city in which he operated was growing fast. I asked him how his company was prospering. He replied: "We have only one difficulty. We are suffering from too much prosperity. We are putting all our profits into extensions and we can't borrow money fast enough to take care of new business."

There is no fundamental reason why the public have gone into the electric light business instead of the grocery business. I have studied the matter from several angles, as private citizen, and as public official, and I find the answer in the way the public were treated by the companies which have developed or merged into these modern public utility corporations. I remember some of those early managers. One whom I worked under in my early apprentice days on line work, was in Seattle for a while. I don't know how he got along in Seattle, but to serve under him on the line was to obtain an advanced course in the art of profanity that would be of great value in driving dogs in Alaska or mules in Missouri.

The ability which accomplishes one kind of result does not always succeed along another line. In Rockingham, N. C., where I was engaged in a hydroelectric development, the main work on the big dam was done by a southern contractor who received a percentage on the cost. A manager from New England was sent

to see that the company's interests were protected. This New England man knew a great deal about some things but the things he did not know about negro labor would fill volumes. He watched the negroes lolling along leisurely and singing contentedly at their work, and his impatience grew daily. Finally he could contain himself no longer. He walked up to the contractor and said: "If I were handling that gang I could get twice as much work out of them in a day as they are doing now." "Yes," said the contractor, "you could; and the next day you wouldn't have a nigger on the job."

It takes one kind of ability to handle construction work. It takes an entirely different kind to handle the public. Sometimes the two are combined in one man, but many of the earlier officials had to learn their lesson and many of them gave way to the modern public utility official, who realizes a sort of partnership—a community of interest—between himself, his company and the city in which he operates. The modern official of these companies spends a great deal of time in meeting the public, individually and collectively and endeavoring to satisfy complaints. The old time manager would often refuse to see patrons of his company, or having talked with them, leave them with a feeling of resentment.

Reforms come through sentiment, rather than through thought, and it is probable that most of the troubles of public utility companies arose from the accumulated resentment of many men who felt "sore" against the companies.

Public utility companies, as a rule, have gone through the process of development to the point of a public policy of management. Their officials are now courteous and attentive to the public. They are striving to please and they are spurred to additional effort by the very evident fact that their highest endeavor is necessary in order to attain even a moderate degree of public consideration. Also, the corporations are now regulated by public officials well trained in matters of valuation and operation, thus giving each corporation an added incentive to proper regard for the public welfare and comfort.

One trouble with municipal operation is that municipal utilities are not placed upon the same basis as privately operated utilities. The city of Los Angeles with its own water plant charges the bills against the premises and yet it will not allow the water companies supplying a portion of the city to do the same thing.

In some cases public utility corporations are regulated very severely and at the same time competing municipal utilities are run without regulation. A corporation in borrowing money for extensions can use only the property of the utility itself as a basis for a loan. A city borrows on bonds issued against the whole city and secured by the entire taxing power of the city against all private property in the city, including that of the public utility corporation with whom the city may be in competition.

Public utility organizations, whether privately or publicly owned, are dependent for their operation, upon human beings and generally speaking, it is the human element that determines the degree of their success or failure. A boy who has all his bills paid

by a wealthy father does not usually try very hard to earn his own living. A utility that can exercise special privileges in collecting its income and that can tax even its competitor's property to provide money for its requirements, lacks to some extent, a healthy stimulus to hard work and close economy. In some cases it may be necessary that a municipal utility should have these special privileges on the same ground that a high tariff has been deemed necessary to develop the infant industries of the U. S. There are instances, however, where the special privileges exercised by municipal utilities have been the direct cause of mismanagement, graft, extravagance or exploitation of the utility for private benefit.

Another difficulty that stands in the way of proper municipal operation of utilities has been the popularity of the municipal ownership idea. In theory, any line of business could be operated by the government at cost and the goods sold to the consumer at a lower price than if a profit were charged. This sounds all right. Also the public mind instinctively approves of the idea that each individual has a personal ownership in the municipal utility. Therefore, because of the popularity which in a way was an advantage, the municipal utility has been tempted to take advantage of the popularity and in some instances has obtained poorer results for the average citizen than if the utility had been obliged to earn the consideration of the public.

I have heard municipal extravagance excused on the ground that it made jobs for more American workmen. I have found that this is contrary to the facts. I sympathize with the man who has to work with his hands. In one of our Northwestern cities it was recently proposed to increase the budget for salaries. There are an unusual number of men out of work in all cities, at this time. Did the increase provide employment for idle men? Not at all. It provided increases in salaries for a few who now hold offices, and that at a time when corporations are passing dividends and when a corporation official or employee would risk his job if he asked for a raise in salary.

But the public—how about the public? What about the benefit of municipal ownership to the public? Can't a man get better service from his own utility run without profit than from that of another man run to make money for its owner? My answer is that in theory there is no justification for private enterprise. In fact the actual progress of the world in those things which make for greater physical comfort, has been almost altogether accomplished by men who worked for a personal reward. The man who has special knowledge or is in a position of special influence will use that knowledge or influence for the benefit of himself and those to whom he is bound by ties of personal loyalty or association. This is just as true of those in the municipal service as of other human beings. It don't make men more righteous to put them in political office.

I believe in municipal ownership. No man has been more enthusiastic about it than I have. Few men have fought harder or sacrificed more for honest municipal management than I have. I wish the ideal might be achieved in this as in many other fields of human endeavor, but observation of municipal opera-

tion has forced me to the conclusion that the ideal is a long way off and that if municipal operation of public utilities is ever to serve the best interests of the public, it must be conducted upon a basis that will eliminate many of the evils under which it now labors.

Public utility corporations as now regulated by trained experts, managed by men of broad views and are generally giving as good service at as low cost as can be obtained from municipal operation. There have been many criticisms of regulation. I believe many such criticisms are unjustified, but if they were all true, how are you going to get men to be honest under all the temptations of municipal operation if you can't get men to be honest in an office where the whole motive of the office is one of publicity?

Go to the office of the average corporation or the Railroad Commission of your own state and you will ordinarily get courteous treatment and any information to which you are entitled as a citizen or a patron of public service. I have known citizens of Los Angeles to go to the office of the Los Angeles Aqueduct and be met with the question: "Who do you represent?" The mere fact of citizenship gave them no title to the information. How much actual ownership do citizens possess under such circumstances?

In one large northwestern city where there is regulation by a state board, a franchise has been granted to a competing company. In two others, municipal plants are competing with private companies on uneven terms. In the former case, the new company starts with a modern plant and is able to make lower rates than it will when 20 years of necessary changes add to its interest burden. In the latter cases the municipalities give the advantage to the plants that are a part of their political system.

Now, I shall not attempt to argue for fairness to corporations. To many advocates of municipal ownership that does not appeal. Some who will say "give the devil his due," place public utility corporations in a class to whom even that ultra-charitable attitude does not apply. What must appeal to all, however, is the point of view of the public good. How can that best be served? Think a minute. Would you place your brains and money at the service of a community or a neighborhood where you were limited to a maximum earning of 8 per cent on your investment and at the same time given no protection against positive destruction of your property? The continued progress of our Northwest depends on brains and capital. Physical value—that much boasted basis of rate regulation—does not exist. Physical value has no value until coupled with the intangible value of men's brains. It is the water running away to the sea, the iron ore in the ground, the tree standing uncut in the forest. What is called physical value even by the narrowest construction, is raw material plus brains—physical substance plus the intangible element that gives it value for men's use.

To create out of our raw resources things of value to mankind, we must welcome brains and money. Both are necessary. There is some money that will go into speculation, playing for a high stake against great risks. There is other money that demands a guarantee and will accept a lower rate of return. Public

utility investment, under regulation, precludes speculative investment. Do we wish also to eliminate the conservative money? Is it not a clear public fact that if we limit public utility investment to the same rate that can be obtained on mortgages without risk, we must protect that public utility money against loss or have it withdrawn from use as fast as possible?

It is absolutely true that having the old public utility that has gone through the change of 30 years; and having placed it on a basis of limited return; and then having subjected it to ruinous competition—we are saying as plainly as words could say it: "We don't want private capital, here. Any one who invests his money here must expect to have it taken away from him in any way that suits us."

It has been said that all reforms come from the plain people. In the case of municipal ownership this holds true. Those who are feeling the ill effect of bad municipal management are the workmen. The complaints are coming from them. In Los Angeles the investigation of the aqueduct was forced by socialists who are ultra radical on the subject of municipal ownership.

If municipal operation of public utilities is to become a general success it must be by an awakened citizenship who fully realize the evils in existence and demand that municipal operation shall face the same tests of efficiency, honesty and public service as private corporations have to meet. I fear that will be a matter of a good many years and it may be that the public will become disgusted before the necessary house-cleaning shall be accomplished.

For the present, I am convinced that the public good will be best served; the greatest development of our resources achieved; and the "greatest good to the greatest number" realized by public ownership of public resources and private development of those resources under public regulation on terms that will protect the public and encourage private enterprise. In this way the government serves its function of protection and to private enterprise is left those things which always have and always will develop to the highest degree through private enterprise.

What we as students of public affairs are most concerned with is not the carrying out of some theory to which we may be committed, but the solution of the problem of how the greatest total good may be accomplished. What the Northwest needs is development limited only by a proper regard for the conservation of public property and the welfare of the citizen.

There is big constructive work to be accomplished. It offers a field for the maximum endeavor of every public man in the Northwest. I wish that opportunity existed for me to tell you of some of the plans I have for making the Northwest a better country for the whole of us. It is about time that public officials and their opponents stopped calling names and got down to a basis of co-operation. There is room enough in the Northwest for all of us and a great many millions more. What is needed is a combination of government ownership and private enterprise such as already exists in other countries and the West will develop into the greatest country ever known—great in all that the highest type of men may desire as a country in which to live and work.

INDUSTRIAL USES OF FUEL OIL

BY F. B. DUNN.

(Continued.)

Oil Burners.

The history of oil burners dates from the early part of the last century. Records of improvements have been kept by various writers and the patent office. Such writers on oil fuel as Brannet, Booth, North, Hodgetts, Lewes, Percy, Henry and Goulichambaroff, have described in detail the successes and results obtained by the inventors.

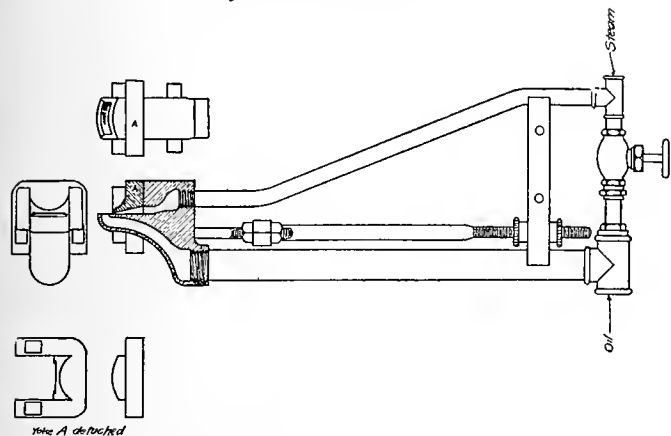


Fig. 21. N. N. Best Burner.

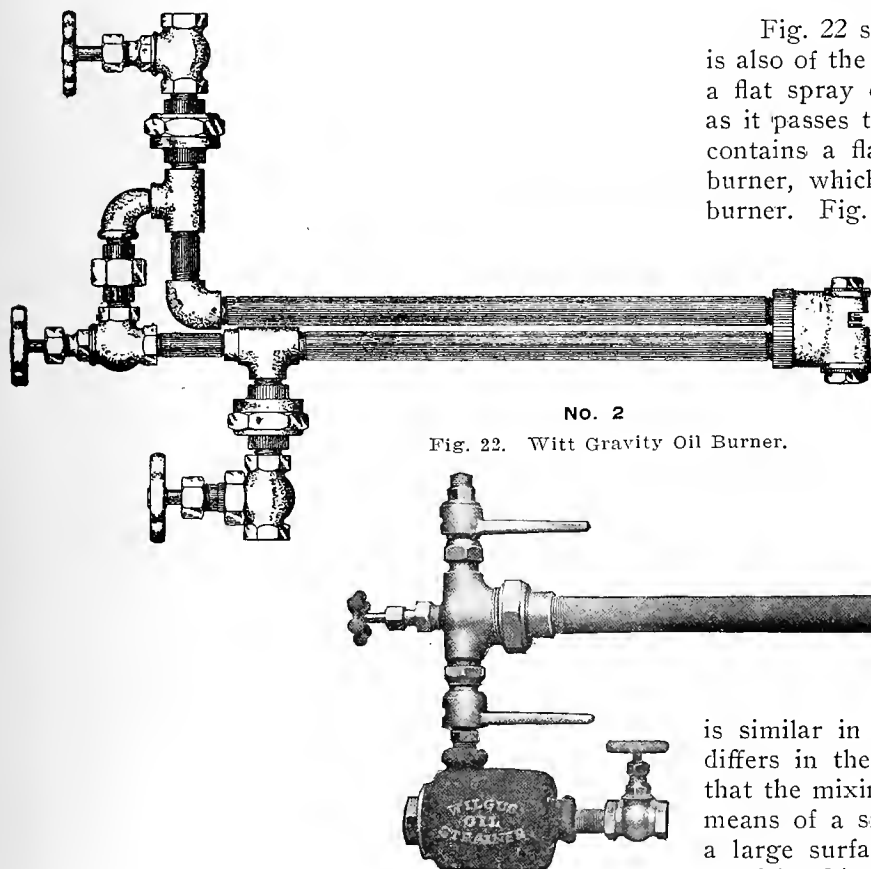


Fig. 22. Witt Gravity Oil Burner.

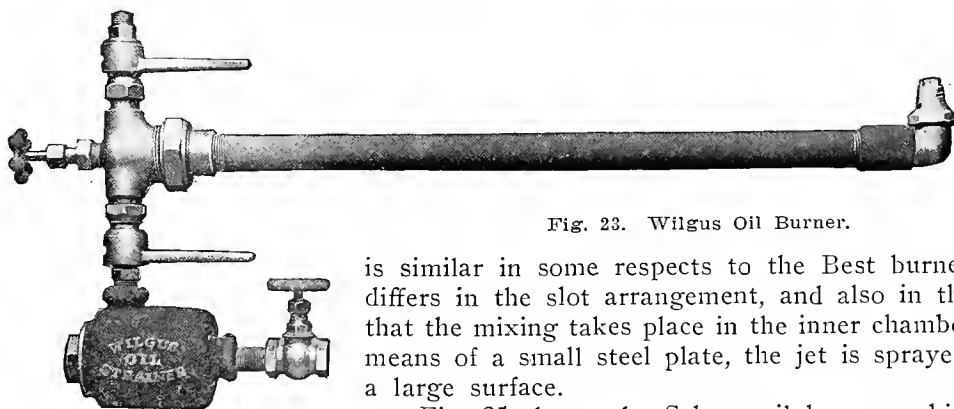


Fig. 23. Wilgus Oil Burner.

Various types of oil burners are illustrated, in order that the reader may have an idea of the methods adopted by the inventors to atomize the oil. These burners are in successful operation in plants visited by the author in various parts of the world.

Fig. 21 shows the W. N. Best oil burner. This is termed an outside mixer because of the fact that

the mixing takes place at the outer tip of the burner. A siphoning action draws the oil from the lower tube, and it is atomized by the steam with which it comes in contact at the top of the tube. This burner has been known to burn tar as well as oil.

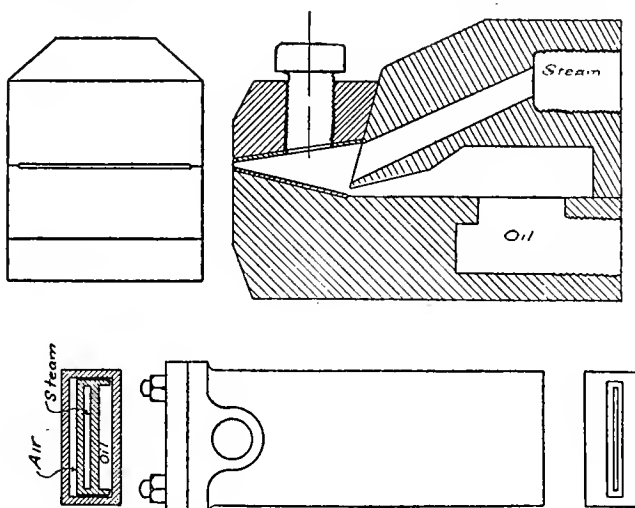


Fig. 24. Hammell Oil Burner.

Fig. 22 shows the Witt gravity oil burner which is also of the outside mixing type. The oil flows over a flat spray of steam coming from the bottom tube as it passes through the upper tube to the tip, which contains a flat slot. Fig. 23. shows the Wilgus oil burner, which operates much the same as the Witt burner. Fig. 24 shows the Hammell oil burner which

is similar in some respects to the Best burner, but differs in the slot arrangement, and also in the fact that the mixing takes place in the inner chamber. By means of a small steel plate, the jet is sprayed over a large surface.

Fig. 25 shows the Schurs oil burner, which has been designed to atomize the oil at three different points. The first atomizing point breaks up the oil. The tube superheats the spray, and the second atomizing point breaks it up into a finer and more perfect mixture. At the third atomizing point or tip the spray forms into a flat stream; this third point acts as a carburetor, changing the spray to a vapor.

Fig. 26 shows the Grundell-Tucker oil burner. The burner consists of a fitting having an internal dividing wall. An air pipe forming the shell of the burner is screwed into the mixing head; this head has a number of spiral grooves which give to the mixture a whirling motion. The burner is operated with compressed air.

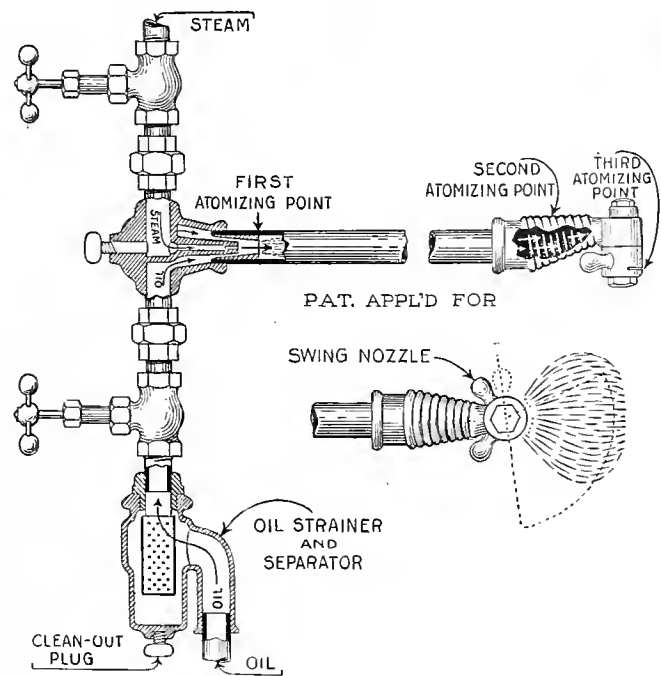


Fig. 25. Schur's Oil Burner.

Fig. 27 shows the Hereshoff oil burner, designed to operate with either steam or air. Fig. 28 shows the Lasso-Lovekin oil burner. This consists of an air tube, and a centrally located oil tube passing to the tip. The latter is provided with a series of converging, helically arranged jet apertures around the oil nozzle. Passing through the oil tube is a regulating rod tapered at the end to spray the oil in con-

one another, so that the stream is broken up. The oil tube contains a regulating spindle with a pointed end fitting the conical end of the tube, which itself serves as a valve to regulate the supply of oil.

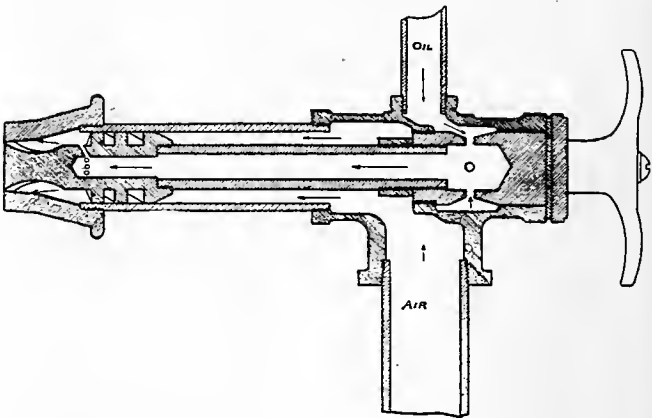


Fig. 26. Grundell-Tucker Oil Burner.

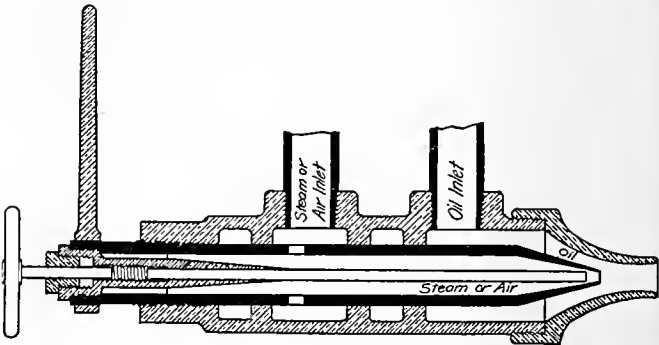


Fig. 27. Hereshoff Oil Burner.

The oil enters the mixing chamber through radial perforations, or inclined ones, the issuing streams, in either case, being broken up by opposing surfaces. The steam or air enters the mixing chamber through passages, parallel to the axis of the tubes. The channels through which the mixture escapes to the burner head may be formed as slots in an enlargement at

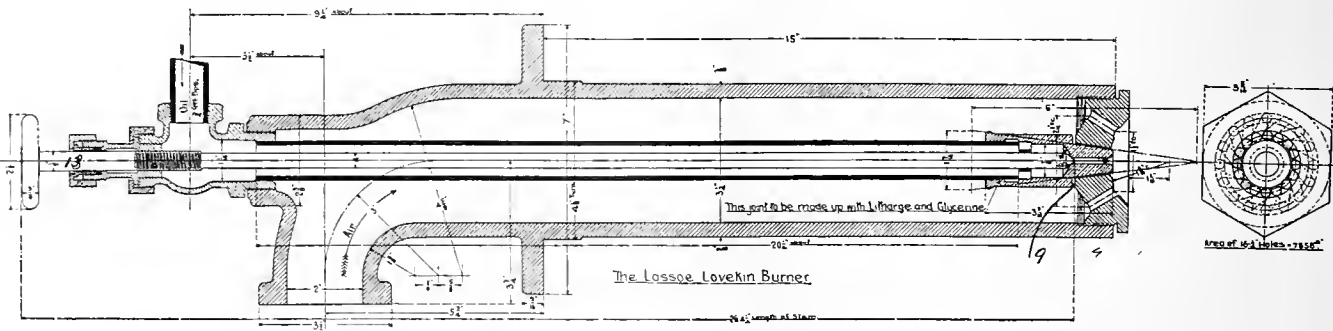


Fig. 32 shows a number of low pressure oil burners made by T. P. Jarvis. Fig. 33 shows the McDonald flue oil burner. This oil burner was tried out by the U. S. Naval Board. Fig. 34 shows a mechan-

A temperature of about 125 degrees has been found to produce the best results. When oil is heated above the flash point, trouble occurs. The carbon will precipitate and settle in the pipe lines and at the

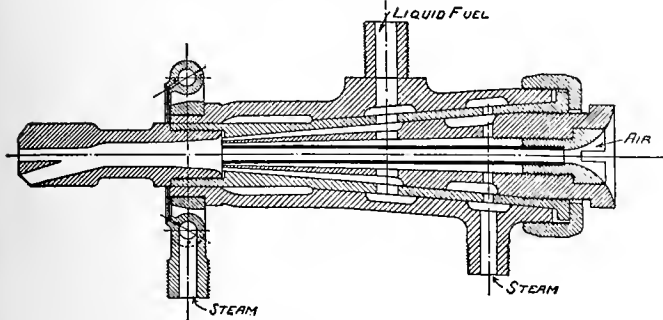


Fig. 30. Holden Oil Burner.

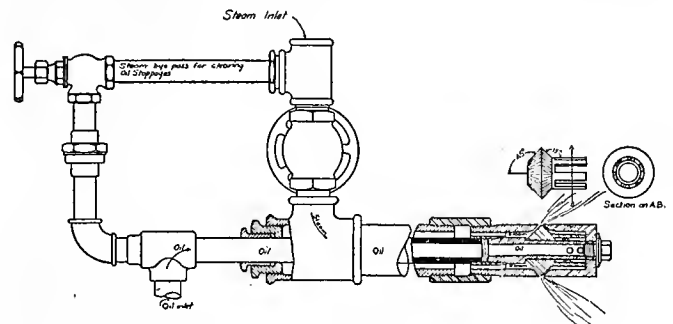


Fig. 33. McDonald Flue Oil Burner.

ical burner used in the Baku oil fields of Russia. The spraying is effected by two sets of spiral guide blades, one set within an inner tip and one within the outer

burner tip. There is also a danger of explosion, if there are any leaks in the oil line. When the oil is heated before reaching the burner, less air or steam

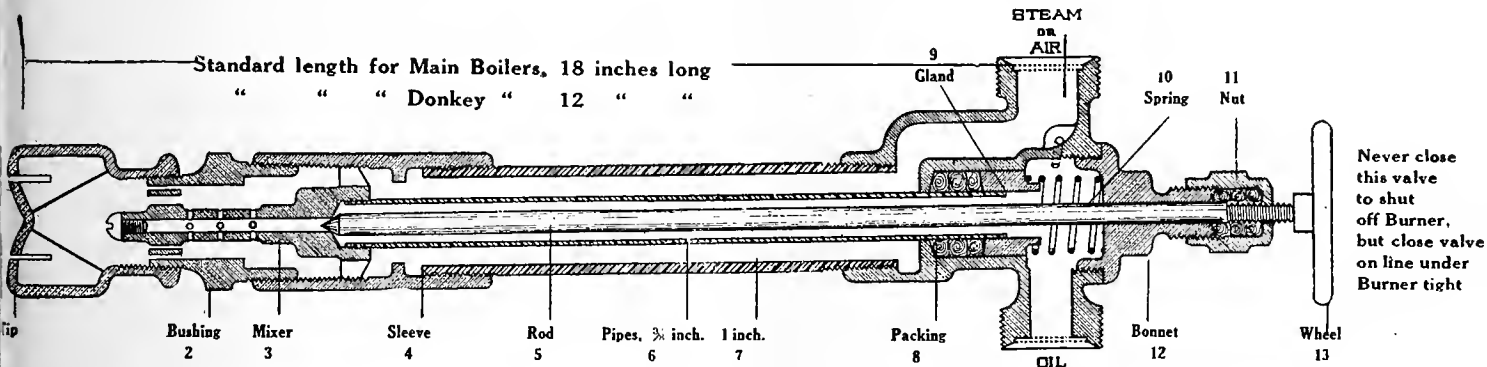


Fig. 31. Staples & Pfeiffer Oil Burner.

tip. The outer spraying tip is removable, so that as the edges wear, new tips can be inserted, or special tips can be placed for use under certain pressures or temperatures of the oil. Fig. 35 shows the naval fuel oil burner, devised to operate by mechanical action. Modern types of mechanical oil burners showing the furnace arrangements will be treated later.

will be required to atomize it. This is an important point, for it has been proven in practice that burners

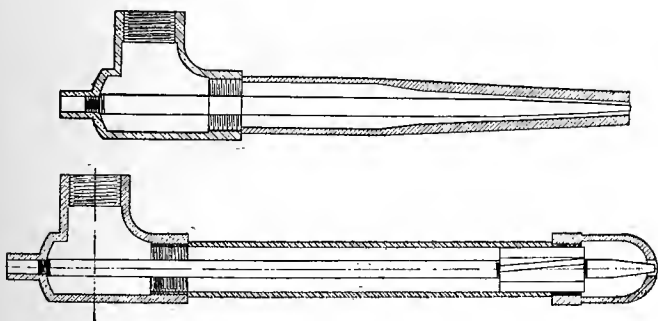


Fig. 32. Jarvis Oil Burners.

A close inspection of the various types of oil burners illustrated, will show clearly that it is necessary to heat the oil in order to properly atomize it. Experiments have proven that fuel oil will not burn in a solid mass, but that it must be broken into minute particles by heat and mechanical action, and then immediately exposed to air.

Heating the oil lowers its viscosity, with the result that any suspended water more readily separates out.

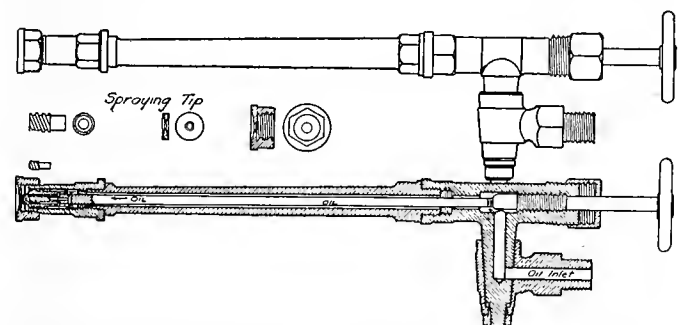


Fig. 34. Mechanical Burner Used in Baku Oil Fields.

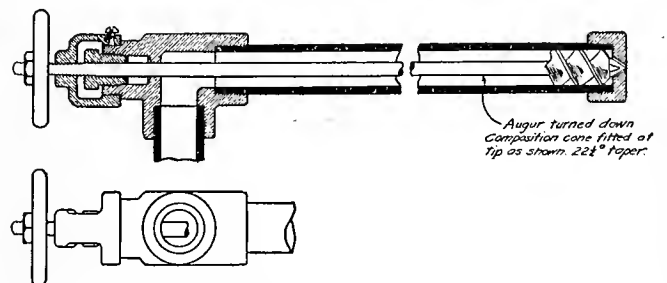


Fig. 35. Naval Fuel Oil Burner.

require at least 3 per cent for perfect atomization, and many burners are in practice using from 5 to 10 per cent.

Air pressures as low as 10 ounces are at present being used with excellent results under especially constructed furnaces.

Compressed air has been found more economical than steam as an atomizing agent in brick, lime and cement plants, where the units are a long distance apart.

In many cases the cost of installing and operating an electrically driven air compressor is much less than that of installing and operating steam boilers. The losses due to condensation are also avoided.

Many plants are fitted with burners that have to be forced to get sufficient steam from the boilers. This is bad practice, for when a burner is forced, excessive amounts of steam are required for atomizing. Incomplete combustion and high stack temperatures, with their attendant losses, are bound to occur, and by forcing the burner and centralizing the heat, tubes and sheets may be blistered.

For all these reasons, the greatest economy can only be secured by installing an ample number of burners to supply all the fuel needed by the furnaces without forcing.

(To be continued.)

Automobile headlights are to be abolished within the city limits of Baltimore. It is claimed by the advocates of such a restrictive measure that the fierce, blinding headlight is not needed along the lines of usually well-illuminated city streets, while on the other hand the use of the lights is productive of danger and discomfort.

Meter deposits and other charges made by public service corporations before service connection will be made are being investigated by the California Railroad Commission. The argument in favor of such charges regards them as a tender of good faith. To require public service corporations to give services to persons they do not know will be virtually a deprivation of property without due process of law.

A wireless telephone for train service has been perfected by Dr. Frederick Millener for use on the Union Pacific Lines out of Omaha. It may be used as an intercommunicating telephone from car to car, a long distance wire telephone when the train is stopped at a station, and when the train is in motion between stations, a wireless telephone by means of which it is possible to talk to the train ahead, the train behind, or the station. The device is so arranged that while talking from car to car it is selective talking and selective signalling. While talking long distance by wire, only one person can talk from the train at a time, and the train is connected to the city trunks. On leaving the station, from any car you can call the baggage car, requesting them to start the wireless generator. As soon as that is done, the party can commence to talk. The distance which the message travels is the distance from the aeriels on the train to the wire telegraph lines alongside the track. A pair of these wires have been balanced up and equipped with condensers around the telegraph instruments, and are used as an antenna.

GAS VS. ELECTRICITY FOR COOKING.

BY R. C. POWELL.

(This paper is believed to be as fair and impartial statement of the relative merits of gas and electricity for cooking as has yet been prepared. It was presented at the 22nd annual convention of the Pacific Coast Gas Association, the author being superintendent of electrical distribution for the Pacific Gas & Electric Company at Oakland, Cal.—The Editor.)

During the last three or four years there has been considerable effort put forth by manufacturers of electric devices, and to some extent by electric central stations, towards an extensive introduction of electricity into the heating field. Large numbers of various heating devices have been sold and are being sold. But these have been principally irons, toasters, percolators, soldering-irons, etc. Comparatively few ranges have been sold, although a few fireless cookers and bake ovens have been introduced.

Recently, manufacturers of electric ranges have become active and are putting out a very excellent appliance. Some of these have been installed in a number of United States battleships and according to reports are giving excellent results. For this service, however, the use is principally baking, since boiled foods are cooked with steam. It must be remembered, however, that the saving in space of electric ovens over the coal-fired type is an item of no mean importance aboard ship, and electricity is generated very cheaply—one cent, or less, per kilowatt-hour. The success of electric cooking for marine service is of no assistance to us in our present discussion and I mention it only to bring before you one of the latest achievements of electricity.

In England, electric cooking and heating has made considerable progress and there seems to have been more agitation and discussion among the central station men there than here. This may appear strange in view of the fact that England is a country in which there is a high gas consumption, and where the electric central station industry has not been developed to a point comparable with our own. Electric appliances have to some extent been put out by English central stations on a rental basis. In Germany, also, there is increasing interest regarding electric heating.

The question of electric cooking and heating has always been an interesting one to the electrical man, because to him it represents a field as yet unconquered, and to this extent, electricity "is still in its infancy."

In coming before you with this paper, I assume that the growing use of electric heating devices has at least stirred up some interest in the gas man, if it has not brought him to a point of wondering what the effect is to be upon the gas business. I hope what I have to say will be of interest to you and shall attempt to attack the question from the impartial viewpoint of one connected with a company manufacturing and distributing very extensively both these would-be competitors.

If electricity is to compete with gas on a large scale it will, of course, be necessary to deliver electric power to the consumer at such a price that the net result as regards service and cost will be approximately that of gas. This net result will depend upon (1) the efficiency of the consumer's appliance, (2) the

cost per cubic foot for gas, or per kilowatt-hour for electricity as delivered at the meter. The claims of the manufacturers of electric ranges are greater cleanliness and freedom from disagreeable products of combustion, high efficiency, and decreased loss of weight in cooking.

I have not been able to find very much reliable data regarding the efficiency of either gas or electric cooking and heating—most of the figures given being apparently estimates or mere guesses.

In a paper before the Institution of Electrical Engineers (England) in 1911, Mr. Harold Gray reports some experiments he made with gas and electric cooking. He evaporated one pound of water at various rates of cubic feet per hour and from his figures I find an efficiency of 32.5 per cent at 3 cubic feet per hour to 38.8 per cent at 10 cubic feet per hour with gas of 600 B.t.u. Evaporating water with electricity he obtained 91 per cent with a "self-contained one pint saucepan," using a hot plate with aluminum utensil 65.2 per cent, and with an earthen ware pot 62.4 per cent. The mean of his results for electric cooking gives an efficiency of 75 per cent. With a gas oven of 6400 cubic inches, 8 pounds of bread were baked in 58 minutes with 31 cubic feet of gas, and 9 pounds of bread were baked in an electric oven of 6137 cubic inches in 52 minutes, consuming 0.92 kilowatt-hour. With gas at 90 cents per thousand and electricity at 4 cents per kilowatt-hour, the cost per pound of bread with these ovens would be approximately equal. It may be interesting to note that in England the rates used in discussions of this character are about 60 cents for gas and 2 cents for electricity.

In 1913, Mr. T. P. Wilmshurst, in a paper on "The Commercial Aspect of Electric Cooking and Heating," deals with the loss of weight in cooking and with the heating of water. With various kinds of meats he found the average loss of weight to be: Coal range, 34 per cent; gas, 23 per cent, and electric, 11 per cent.

His data on water heating appear to have been estimated and he allows the following: Coal, 10 per cent; gas, 50 per cent, and electric, 90 per cent. He also mentions a test on a "Belling electric geyser," which gave over 97 per cent efficiency.

Most writers on the subject usually give for coal and coke an efficiency of 2 to 10 per cent, gas 12 to 15 per cent, and electric 80 to 90 per cent. These men are usually electrical and I am afraid in their enthusiasm they have overestimated the efficiency of their own appliances and underestimated those of gas. With some tests of my own, I found the following: Electric hot plates (three types) to vary from 22 per cent to 45 per cent efficiency; gas (assumed at 600 B.t.u.) 35 per cent efficiency when heating water in an aluminum tea kettle holding about $1\frac{1}{2}$ gallons, and water heated on an electric range of very improved type, 62 per cent. From Mr. Gray's and my own experiments, I believe the all-around efficiency of gas is at least 25 per cent and electric is not over 75 per cent.

When converted into heat, 1 kilowatt-hour gives 3412 B.t.u., and if we assume electricity to be used at 75 per cent efficiency, 60 kilowatt-hours will give the same useful heating as 1000 cubic feet of gas of 600 B.t.u. at 25.6 per cent efficiency—very easy figures to remember, 60 kilowatt-hours equals 1000 cubic feet gas of 600 B.t.u. as ordinarily used for heating and cook-

ing. Hence, on a basis of cost for useful fuel we have:

Gas at \$0.75 per M.	equals	electricity at 1.25 cents per kw.h.
0.90 " "		1.50 " " "
1.00 " "		1.67 " " "
1.25 " "		2.08 " " "
1.50 " "		2.50 " " "
1.75 " "		2.92 " " "
2.00 " "		3.33 " " "
2.25 " "		3.75 " " "
2.50 " "		4.17 " " "

Now gas, in some places, is being sold for 75 cents per thousand, but there is not much electricity being distributed for ordinary cooking purposes at $1\frac{1}{4}$ cents per kilowatt-hour, or anything near this price. Electricity for heating purposes is, however, sold at 3 and 4 cents, and in communities where gas could not be sold profitably at \$1.75 per thousand. Hence, in the smaller towns and country districts the electric cooking and heating business should develop to considerable proportions, particularly where hydroelectric power is cheap and fuel high.

For certain irrigation projects electric plants have been built and the power transmitted for pumping. In winter since there is no pumping, the plants are practically idle, and during this season, electric current can be produced so cheaply as to be able to compete with almost any other fuel. A number of such plants have thus quite a heating and cooking load, but these cases, like the application of electricity for heating in marine service, while sure to greatly increase, are under somewhat special conditions and are not much of a factor as a competitor of gas.

In the large cities where gas is distributed, electricity is sold for from 6 to 10 cents or more in the residence districts, where the larger portion of the gas is consumed. Here in California the prevailing rate is 7 cents, and the rate for cooking and heating about 3 or 4 cents, sliding perhaps to 1.5 cents after about \$10 or \$12 worth for the ordinary range has been consumed at the higher rate—which means the rate is practically 3 or 4 cents. These are pretty low rates for electricity; in fact, electricity in many parts of California is extremely cheap and many of the electric men doubtless feel in some cases, have more than reached bottom.

Some of the electrical men are very enthusiastic over the possibilities of electric cooking—the man with ranges to sell seeing a market for millions of his appliances and the central station man beholding an enormous demand for his product. In order to develop this business against gas competition it is, of course, necessary to offer a very low rate for electricity. The central station is tempted to do this since there seems to be among many electrical men a belief that the taking on of a large cooking load will so improve the load factor as to ultimately return a good profit, and make up the loss he must sustain in developing this business. We shall show the fallacy of this later on.

First of all, let us see how much heat we really receive in either a cubic foot of gas or a kilowatt-hour of electricity. By insulating the electric appliance against loss of heat we can approach more or less closely to 100 per cent efficiency. With gas, however, it is not possible to approach so closely to the theoretical with a simple appliance, on account of the heat lost in the products of combustion. This waste heat is (1) that required to raise the gas and air to the tem-

perature of the products of combustion amounting to 8 to 10 per cent, (2) the latent heat in the water vapor formed in burning the hydrogen of the gas, and which cannot be recovered in any appliance operating at, or above, the temperature of boiling water. This latent heat is 7 or 8 per cent for gas containing 50 per cent hydrogen. Therefore the highest efficiency we can theoretically attain with ordinary gas for cooking purposes is about 85 per cent. Thus, 600 B.t.u. gas has a net value of approximately 500 B.t.u. Hence, at a 4 cent electric rate, the consumer has delivered at his meter 3412 B.t.u., or 853 B.t.u. for 1 cent. At a 90 cent gas rate he receives 500,000 B.t.u. per thousand or 5556 B.t.u. for 1 cent. That is, the gas man delivers to him for 1 cent, 6.5 times as much (what we might term theoretically usable) heat as the electric.

Since the profits in each case are about the same, gas manufacture must be fundamentally more efficient than electric generation, either from the physical or capital standpoint, or both. If the electricity happens to be generated by an oil-burning steam plant, we may readily compare the physical efficiency of manufacture for both electricity and gas, by taking ratios of heat energy in finished and raw material, since there are no by-products in the electric plant and none of much consequence in the oil gas plant. If it takes nine gallons of oil to make a thousand cubic feet of gas and 10 per cent is lost in distribution, the net efficiency is 37.5 per cent. The very best steam electric plants could scarcely have a yearly efficiency of over 10 per cent from oil barrel to switchboard and 80 per cent efficiency of distribution is high, so the physical efficiency of manufacture and distribution would not be greater than 8 per cent.

Now, if we return to our original figures of 25 per cent and 75 per cent efficiencies for gas and electricity as actually used, we shall find physical efficiencies of 11 per cent and 6 per cent for gas and electricity, respectively. Hence, oil gas manufacturing has, roughly, twice the efficiency of that for electricity as applied for cooking purposes. If we have hydroelectric power the efficiency from water to cooking utensil would vary from about 25 per cent to 45 per cent, depending upon size of plant, length of transmission and general efficiency.

Besides the raw material wasted, which we have just expressed in the term physical efficiency, the cost of manufacture depends upon the efficiencies of capital and of operating expenses. By the efficiency of capital, I mean, the number of units of energy, for example, cubic feet of gas, or kilowatt-hours electricity that can be manufactured and distributed per unit of capital invested. This efficiency, of course, is not an absolute one as is the physical efficiency, but only relative, cause we have no value known to represent 100 per cent.

In order to compare the capital efficiencies of gas and electric plants we shall find it convenient to express the capacity and output of the gas plant in electrical units, which, of course, amounts to determining the size and cost of an electric system designed to displace a gas system. As you all know, there is no commercially successful means of storing electricity on a large scale in any way comparable with a gas holder, so that at any instant the electric plant cannot generate power in excess of that taken by the consumers, plus

the losses; the plant must increase and decrease its output exactly to suit the varying demands of the consumers, with no storage of any sort to fall back upon. The size of an electric plant is thus rated according to its maximum rate of turning out energy, whereas a gas plant is rated according to the amount of gas it manufactures in a given time, for example, in a day. However, the gas actually taken by the consumers varies from hour to hour during the day and unless the generating and distributing system is large enough we can conceive of there being such a great demand over a period of say, one hour, that there would be a tremendous drop in pressure and at the end of the hour, if the demand were severe enough, many consumers, if not all, would be unable to obtain any gas whatever. It is, therefore, not altogether illogical to rate the gas plant in terms of thousands of cubic feet per hour, which will then come pretty close to the idea of an electric plant of so many kilowatts. For we can assume the output from the gas plant over this hour to be uniform and we have seen that a thousand cubic feet of gas are equivalent for cooking purposes to 60 kilowatt-hours, or with 10 per cent loss to 54 kilowatt-hours, delivered. Hence, we may replace our gas plant by an electric one having a capacity of 54 kilowatt-hours, plus electrical losses for each 1000 cubic feet maximum hourly output.

Let us now compare the costs which will be, of course, very general and approximate, but sufficiently accurate for our purpose.

A large gas generating and distributing system will cost approximately \$5000 per 1000 cubic feet maximum hourly generating capacity. The cost of an electric system to do the same work for the same capital would have to be \$92.50 per kilowatt demand at the meter. Thus a gas system costing \$92.50 per unit will carry the same cooking and heating load as a steam electric system costing \$250 per unit, or an hydroelectric system at \$450 per unit. That is, the gas system capital efficiency is about two and three-quarter times that for the steam electric system and nearly five times that for the hydroelectric.

The preceding takes into account the assumed efficiencies of the appliances. If we neglect these and consider only the theoretically usable heat, we find that for each 1000 B.t.u. per hour capacity, the gas system requires \$10 capital, the steam-electric \$73, and the hydroelectric \$130, or the relative efficiencies are as 1 to 7 to 13.

While the manufacture and use of gas is, as all of our processes for utilizing natural heat resources, notoriously wasteful, it is a great conserver of these natural resources compared with steam electric transformation as applied to cooking. The opposite is, of course, true for the hydroelectric system. But we see the cost is so great as to preclude it from competition with gas excepting in some special cases, and until either the price of oil goes up considerable or the cost of developing water power and building distributing systems is lowered.

As for operating cost efficiency, we know it to be lower for gas than for electricity—not so much interest, depreciation, maintenance or operating labor per unit as delivered or used.

We have yet one other point to consider. The capital invested in electric systems is very large and hence

the capital costs, interest, depreciation, etc., are a large portion of the total operating costs, particularly in the case of hydroelectric power. Therefore, we must keep our equipment as busy as possible. Now, we have a term called the load factor which tells us how busy our electric plant was during a given time. It is the ratio of the actual kilowatt-hours generated to the number which could have been generated had the plant been loaded to full capacity for that time. This varies from about 25 per cent yearly load factor for a medium-sized plant with a small power load to 40 per cent for large cities like Chicago. The yearly load factor for the Pacific Gas and Electric Company is 60 per cent for the whole system, and a similar company operating in Los Angeles and vicinity has a factor somewhat higher than this. Not very many systems, however, reach even 50 per cent. The more consumers we connect and the more diversified the use to which they put electric service, the better becomes the load factor. But if their maximum demands for power all come at the same time, the load factor is not improved much.

Because people do cooking in the day time and there are obviously a great many prospective consumers in this field, some of the electric men have reasoned that the load factor would be so improved as to greatly reduce the cost of electric power, since the equipment would be kept busier, as it were, and thus the investment charges, which are a large item, would be reduced. However, the actual facts for the case investigated by the writer are, that the yearly cooking and heating peak is simultaneous with the light and power peak and the addition of a large cooking and heating load would really reduce instead of increase the yearly load factor.

For a gas plant supplying a large territory of several hundred thousand inhabitants, I obtained the hourly output for each hour of a day in December, judged to have the maximum hourly output. These hourly outputs I reduced to equivalent kilowatt capacity and thus obtained the load curve which an electric plant would have if the gas plant were entirely done away with, and all the gas cooking and heating done by electricity. I have also plotted in the same way the present total electrical load for approximately the same territory. You will observe what sharp peaks the heating load has. The heating peak comes between 5 and 6 p. m. in summer as well as in winter, whereas the light and power peak comes about 6 p. m. in winter, but about 8:30 p. m. in summer. This is, of course, due to the heavy lighting load shifting according to time of sunset. The power load—that between 7 a. m. and 6 p. m.—is practically the same during the year, but during these hours the heating curves show the present gas load to be much greater for winter than summer. The daily load factor for the three December curves are: Light and power, 59 per cent; heating 33 per cent, and "total," 40 per cent.

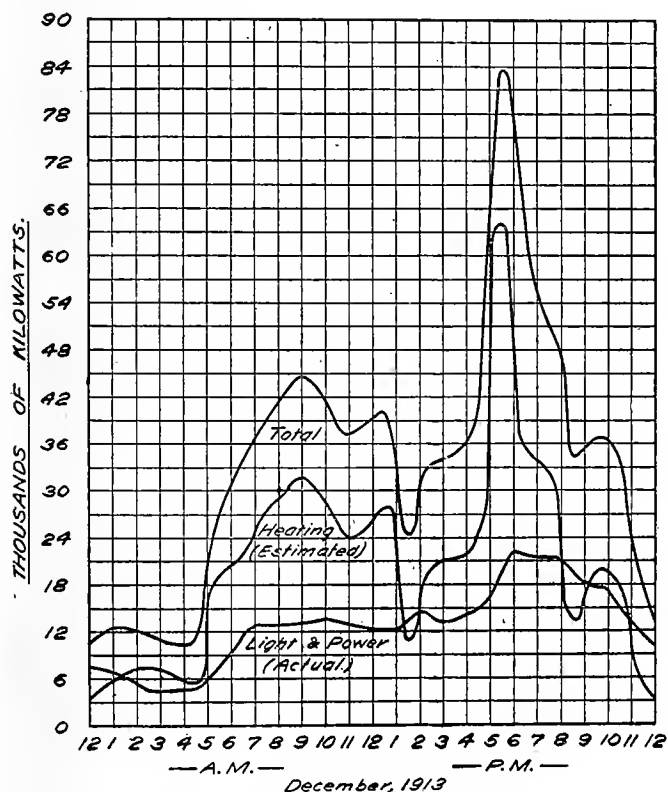
What we really are interested in, however, is the yearly load factor. From the total gas manufactured during the year and the hourly maximum output I have found the gas plant yearly load factor to be 29 per cent. The light and power yearly load factor for the same territory is about 50 per cent. The combined electric peak, if all the gas were to be supplanted by electric heating and cooking, would be 84,000 kilowatt and the yearly load factor 35 per cent.

The increased production would not be able to overcome this heavy reduction in load factor so that the average price per kilowatt-hour would be increased instead of being decreased. Thus since a very large electric cooking business can only be built up by a low cooking rate, rates for other classes of really more profitable business would have to be raised considerably in order to bring up the average and make the plant as a whole profitable.

Summary.

Under special conditions such as aboard ship, and where hydroelectric power is applied principally to seasonal industries, as for example, irrigation work, electricity has the field as regard gas.

In small towns where gas cannot be sold for less than \$1.75 per thousand cubic feet, electricity is a competitor of gas, and a very strong one. In this, the electric man is justified in making a determined effort to increase his business by adding cooking devices and he should succeed.



LOAD CURVES FOR A SYSTEM HAVING A
LARGE ELECTRIC, COOKING, AND HEATING LOAD

In the larger communities where gas is sold for \$1.00, or less, per thousand, electricity has not under present or prospective conditions, much chance to become a competitor of gas to any appreciable extent, for the manufacture and distribution of gas rests upon a much firmer economic basis. The electric central station should not waste any effort in attempting to compete with gas for cooking, where a reasonable gas rate prevails, because a community as a whole cannot, nor will not, sustain an increase in economic loss.

A controversy over aqueduct water rights on Cottonwood Creek in the Owens Valley district has been revived by the Southern Sierras Power Company which has applied to the Forest Service for a right of way along the creek.

INSTALLATION OF HIGH VOLTAGE TRANSFORMERS.

BY C. S. KNOWLES.

(Details are here given of the practical procedure followed by the author in installing transformers for the Pacific Power & Light Company from whose Bulletin these facts are taken and to whose courtesy we are indebted for the cuts.—The Editor.)

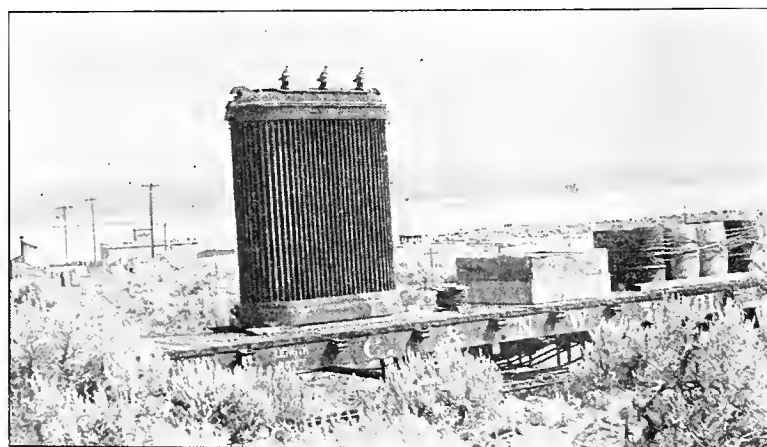
The installation of high voltage transformers is one of the most difficult propositions of all electrical practice, as it is necessary to handle them in an upright position, and considerable difficulty is experienced in finding suitable conveyances and block and tackle to move them from railroads to the stations where they are to be installed. I have hauled a five ton transformer 10 miles over bad roads on a farm wagon which was only supposed to handle $2\frac{1}{2}$ tons. I have also hauled a $7\frac{1}{2}$ ton transformer 12 miles and found it

about 90 degrees C, being blown into the bottom of the transformer and allowed to escape at the top, using an ordinary hot air furnace, blowing cold air into the bottom of the furnace and taking the hot air from the top. It is necessary to use a gasoline engine to drive the blower in localities where current cannot be obtained for driving motors. It is then necessary to fill the transformer with oil before the windings have cooled to outside temperature. The drying and filling process usually requires about 50 hours and the transformer is then ready for service.

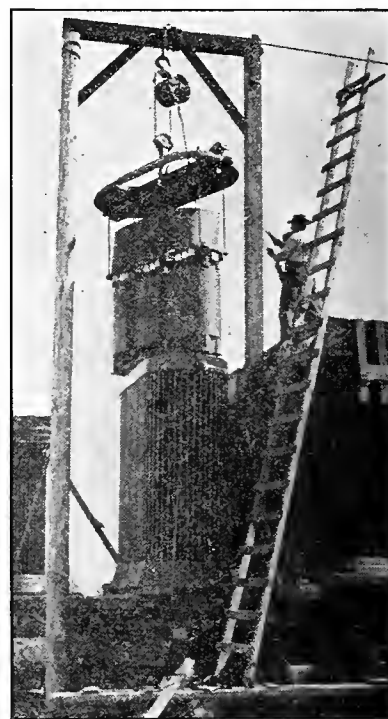
After the transformer is put in service it should receive a certain amount of attention such as noting the height and temperature of the oil. The height of oil should be kept within the limit of one-half inch from the mark indicated on the gauge glass, and a transformer should never be operated continuously



Hauling 1000 kw. Transformer to Priest Rapids Plant.



200 kw. Transformer at Coyote Rapids.



Lowering Coils Into 66,000 Volt Transformer.

necessary to use planks over a good portion of the road to prevent the wagon wheels from cutting through the roadbed. In this case, after about 35 hours of hard work, we covered the 12 miles without mishap, and got within 100 yards of the permanent location of the transformer when it was upset into the river because a snubbing post broke.

After high voltage transformers are placed in their permanent positions the work is not completed. It is necessary to make a thorough inspection of the transformer, windings, etc., to see if any displacement has occurred during the trip and to make sure that all foreign matter has been removed from the inside of the case and that all bolts and connections are tight. It is then necessary to remove all moisture from the windings, which may have collected during transit. This moisture is removed by means of air heated to

with an oil temperature above 65 degrees C., nor more than two hours with an oil temperature of 75 degrees C. This is in accordance with the manufacturers' guarantee.

Water cooled transformers should never be operated continuously without water, and the cooling water should never be more than 25 degrees C when entering the cooling coils. If water cooled transformers are to be operated without the cooling water for a short period, more care should be exercised to see that the oil does not exceed a temperature of 75 degrees C. When the oil reaches this temperature the transformer should be taken out of service immediately. Serious results are sure to follow if this precaution is not taken.

From past experiences we have found that it is necessary to filter the oil in all transformers over

25,000 volts, at least once a year, for the purpose of removing moisture. We find that oil which tests 40,000 volts across a .2 in. gap will only test between 25,000 volts and 35,000 volts after being in service for a year. We have had transformers operating with oil that did not test 10,000 volts, but this is risky practice. Oil in all high voltage transformers should have a dielectric strength of at least 35,000 volts.

If a transformer is used for stepping down voltage and is protected on the primary side with fuses, and the fuses should blow for some unknown reason, the transformer should be re-fused, making sure that the proper sized fuses are used, and should be again connected with the line. If the fuses blow once more, look for trouble. Do not use larger fuses, as this is apt to ruin the transformer. I know of one place where the transformer was fused with wire solder when a 6 ampere fuse should have been used.

I believe that if due care is exercised in fusing and setting trip coils, a good protection on both high and low sides is provided, and burn-outs due to short circuits and overloads will be reduced to a minimum. Also, I believe that the high tension leads and the tops of transformers should be cleaned at least every month. We have some transformers on our system now which have been in operation over three years and have not been cleaned during all this time.

While mentioning this point, I urge all persons to exercise particular care when working around live transformers. It is essential that every employe should exercise the utmost caution. Never take anything for granted. Never take any chances. Electricity is faster than you are and is no respecter of persons. Every transformer workman should have for his motto: "Safety First."

PAPER PIPES FOR DRYING PLANTS.

A unique method for conveying heated air for drying purposes has been successfully tried out in a San Francisco tannery. The problem was to dry the hides at a minimum of expense for installation and operation.

The air is first heated to 110 degrees Fahr. by means of exhaust steam circulating through an old tubular boiler. The exhaust from the reciprocating engine is first used to heat the boiler feed water, then circulates through another heater for hot water for use in the plant and is finally allowed to circulate through the water chambers of the boiler, the condensed water being drawn off and added to the feed water supply.

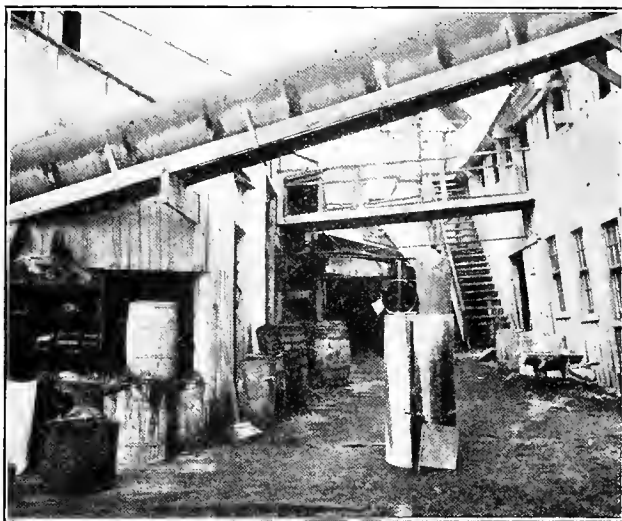
Spiral strips of fluted metal have been placed in each fire-tube so as to regulate the intake of air and bring every portion of it in contact with the heating surface. A 40 in. blower is used to exhaust air through the heater and force it through the pipe.

The main supply pipe, as seen in the accompanying illustration, is 2 ft. in diameter and consists of five wrappings of manilla paper with an ample application of glue binding between wrappings.

A wooden form shown in the bottom of the picture, was first made up of 1 in. battens into a truncated cone or cylinder with a taper of $\frac{1}{4}$ in. to the foot.

This taper was necessary so that the pipe may be slipped off when dry. This cylinder was mounted on trunnions, the paper inserted in a slit, afterward filled by a batten, and the whole revolved by a crank. The paper was fed from a roll and the pipe thus made up in 3 ft. and 4 ft. lengths. A coat of shellac completed the job, except where the pipe is exposed to the weather when asbestos corrugated board and tarpaper are used for an outside covering.

The short lengths of pipe are fitted together and strips of metal 3 in. wide riveted on at each joint. A sheet iron expansion coupling is provided for about every ten lengths, these couplings also being used as outlets where required. The form of the coupling is shown in the illustration.



Paper Pipe Conveying Heated Air.

Boxes equipped with simple hinge gate valves are set as needed to divert the flow into laterals. The main pipe is 2 ft. in diameter and has a total length of 320 ft., the laterals are 1 ft. in diameter and total 100 ft. in length.

A pressure of about $\frac{3}{4}$ oz. and a supply of 7000 cu. ft. per minute at 110 degrees is maintained by the fan, this being ample to dry the hides suspended in the lofts. The entire installation cost less than \$150, being designed and constructed on the premises by Mr. Frank Pierce, engineer for S. Bloom & Sons Tannery, where it has been giving ample satisfaction for nearly three years.

The material used in the construction of the pipe included 40 lb. shellac, 12 gal. alcohol, 186 lb. glue and 716 lb. paper, the paper being 56 by 72 manilla rope.

The structure of the atom consists of a central nucleus containing a positive charge of electricity and surrounded by concentric rings of negative electrons. The arrangement of the electrons in an atom depends upon the charge carried by the nucleus. Sir Ernest Rutherford, in a recent lecture before the British Association at Sydney, New Zealand, stated that the element lead might have either of two origins, its atomic weight varying accordingly. Two pieces of lead of similar appearance may have quite different physical qualities. Gravitation is probably a property of the nucleus.

JOURNAL OF ELECTRICITY

POWER AND GAS

FOUNDED 1887

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Much criticism has been directed against central stations for their hesitancy in making rates sufficiently attractive to allow the installation of electric cooking equipment in the homes of city consumers.

The Electric Cooking Load

Many companies in the West have made a low rate in the hope of encouraging this class of business and subsequently have gone back to former rates because the trial, in their estimation, was not satisfactory. In practice it was found that the cooking load overlapped the lighting peak, particularly during the winter months. Additional transformer capacity had to be installed and the expense did not seem to justify the effort. After a strenuous campaign of three months one company succeeded in putting four new consumers on its line and consequently gave the proposition up as a bad job.

The chief difficulty that the new business solicitor met from the prospective electric cooking consumer was the high cost of an electric range as compared with a coal or gas range. This is largely due to the high grade material and finish which must be employed, as well as the expense of manufacturing and selling apparatus for which there is a comparatively limited demand. It consequently seems necessary that an attractive price for the range must precede an attractive rate for the current.

The situation in some of the irrigated districts of the West is somewhat different. The equipment which is necessary to furnish current for pumping service during the irrigation period is idle during the winter months unless a market for cooking or even for heating buildings can be developed. As a result, current is sold in small quantities at a rate as low as one cent per kilowatt-hour.

A rather interesting view of this situation was taken by Mr. P. N. Nunn in testimony given before the Idaho Public Utilities Commission in the matter of the application of the Idaho Power & Light Company and of the Clear Lake Power & Development Company to enter the field served by the Great Shoshone & Twin Falls Water Power Company. Mr. Nunn testified as follows:

"No community can afford long to use electric power for heating, for the reason that whatever may be the cost of developing by water power, there is not water power in the country to supply the demands for power, so the development of energy by steam must become a standard. Now in using coal for steam, we develop electric energy with an efficiency of six, eight, or ten per cent. To turn it back into heat it is being used in competition with heating at an efficiency of fifty or sixty per cent. As a community's use for electricity for the ordinary purposes encroaches upon the surplus of the company, the heating use of electricity must retreat until finally, after the ordinary uses have encroached entirely and absorbed entirely the capacity of the plant, the heating has disappeared and given place to the higher uses of electricity. There are many uses both in town and on the farm which do not now involve the use of power, but for which power will soon be used to great advantage. One thing is certain, in the solution of this great economic question, it will be found that in a community like this it will not pay to use oil and coal

for the pulling of freight trains while we are using the power from water power for electric heating. It will pay better to use the electric power for the railroad and burn the coal or oil for heating."

It should be noted that the opinion refers only to heating buildings and not to cooking food. The rate is one cent per kilowatt-hour or less. There is little or no competition from gas and as a result Idaho has been a most profitable territory for salesmen of electric cooking devices.

There can be no question but what electric cooking is cleaner and handier than any other method yet devised. There are no products of combustion and the efficiency is much greater. Furthermore there is believed to be less loss in the weight of food which is cooked by electric heat. Outweighing these advantages are its admitted greater cost and the longer time necessary to bring the food up to a cooking temperature.

Perhaps one of the fairest and most impartial opinions on this mooted question is that by Mr. R. C. Powell elsewhere in this issue. He concludes that there is a large field for both electric cooking in small towns and agricultural districts, but that it cannot compete with gas in the larger cities. The facts upon which these conclusions are based are most interesting and worthy of the careful attention of every central station man.

In an able paper about what is wrong with municipal ownership of public utilities, published elsewhere in this issue, Mr. Chas. W. Warner incidentally draws an excellent picture of what used to be wrong with private ownership. The former mistakes of private ownership, which were largely responsible for the agitation for public ownership, have since been remedied by private plants, but are now being repeated by many municipal plants. The great error in municipal ownership is the failure to profit from the mistakes of private ownership.

The men who had the initiative and ability to develop technical utilities were seldom able to handle the public. The tactics which were successful in harnessing the water fall and subjugating steam were not adapted to harmonizing the public. Politicians were quick to capitalize the accumulated resentment of the public against the early utility developers but continue to make the mistake of applying political methods in the public service.

Meanwhile the corporations, profiting from their early mistakes in antagonizing the public, are now steadily studying how to please them. Public relation engineers are employed to establish confidence, courtesy and tact are inculcated in employees, and every endeavor is made to bring about friendly relations.

Such a policy, as compared with the indifference and inefficiency of many municipal enterprises, will ultimately win out. The idea of a corporation with a soul is being exemplified every day by a sympathetic understanding of public needs and a broadness of vision which recognizes the rights of others. Most private utilities are now conducted more closely in accord with

the dictates of public welfare than the municipally operated.

The conclusion may therefore be drawn that what was wrong with private ownership has been corrected. Likewise that what is wrong with municipal ownership must be corrected.

Public ownership, in itself, is good. If public funds are available after schools, streets, sewers, police and fire protection have been provided, the other necessities which appear as the concomitant of civilization should also be publicly owned. Private initiative and capital have made the preliminary expensive experiments, so that public ownership may be undertaken without serious risk. But private ownership of quasi-public utilities should not be discouraged until after all public necessities are publicly owned. Nevada, for instance, classifies sewers as a public utility which may be furnished by private enterprise and has given the public service commission jurisdiction over them.

If public ownership, in itself, is good, what is wrong with it? Concisely stated, the answer is political operation. If all the evils of municipal ownership can be traced to political operation, why not abolish it? Private operation of publicly owned utilities, as has been repeatedly demonstrated in these columns, is the one logical answer to this problem.

The engineers have lost another opportunity for having engineering representation on public service commissions in Western states. In Idaho the appointment has gone to John W. Graham, a lawyer, and in California no engineer has yet been announced among the probable appointees.

While no one can object to the presence of representative lawyers and business men on the public utility commissions, it seems no more than right that an engineer should also be included. Telephone, telegraph, gas, electric and railway projects all depend upon engineers for their construction and operation. Valuation and rate making are essentially engineering problems. The training of an engineer is such as to make him an earnest seeker after facts and to give him the ability to determine their proper weight in making decisions. Many of the witnesses in important cases are engineers and their testimony can be interpreted more intelligently by engineers than by lawyers.

According to the present system, appointment to a public service commission is usually regarded as a legitimate method of balancing political debts. Its effect, however, is to unbalance the commission.

The logical answer, of course, is for engineers to enter into politics. Engineering ethics are such as to prevent the individual from seeking office. Yet it is possible for engineering societies to take concerted action on this matter and carry on a campaign to educate the people regarding the fact that an engineering member is desirable on every commission. There has been much talk on this subject in the past but now is the time for action.

What was Wrong with Private Ownership

Engineering Commissioners

PERSONALS

Geo. J. Henry recently returned to San Francisco from a short business trip to Los Angeles.

J. T. Stewart, salesman, Holophane Company of San Francisco, is traveling throughout the Pacific Northwest.

O. E. Clark, district manager, Pacific Gas & Electric Company of Napa, is a recent business visitor at San Francisco.

William Shore, manager of the Montesano Telephone Company of Montesano, Wash., was a recent Tacoma visitor.

Clark Pomeroy recently joined the forces of the Electric Railway and Manufacturers' Supply Company at San Francisco.

E. W. Yerger of the Los Angeles office of H. B. Squires Company has just returned from a hurried trip to his home in Cincinnati, Ohio.

C. H. Johnson, Pacific Coast manager C. A. Wood, Pre-server Company of San Francisco, is traveling throughout the San Joaquin Valley.

P. H. Affolter, manager electrical department, Fairbanks, Morse & Company, has returned to San Francisco. He spent the past week throughout the Sacramento Valley.

H. F. Yost, representative Electric Railway and Manufacturers' Supply Company of San Francisco, recently returned from a successful business trip throughout Nevada.

John A. Britton, vice-president and general manager, Pacific Gas & Electric Company of San Francisco, left for the East the latter part of the week to be gone about three weeks.

W. D. Peaslee, formerly with the Seattle and Portland offices of the General Electric Company, is now with the school of electrical engineering at the Oregon Agricultural College.

H. V. Carter, president Pacific States Electric Company, left for the East the latter part of the week to attend the national jobbers' convention to be held in Birmingham, Alabama.

A. J. Myers, Pacific Coast manager Wagner Electric Manufacturing Company expects to return to San Francisco about the first of the week from Los Angeles, where he has been for the past week.

A. S. Halls, manager electrical department of the Pacific Fire Extinguisher Company at Portland, and **H. P. Miller**, manager of the same department at Vancouver, B. C., have recently resigned from that company and have gone in for themselves contracting, with headquarters at Portland.

J. Paulding Edwards, Fellow American Society Electrical Engineers, after an absence of almost fifteen years from his native city, has recently established offices in the Flatiron Building, San Francisco, as consulting engineer and electric railroad specialist. Mr. Edwards for many years past has been connected with the Northern Electric Railway as consulting and operating engineer.

Richard Sachse has been appointed chief engineer of the California Railroad Commission in San Francisco. Mr. Sachse entered the service of the commission in 1911 as assistant engineer; was promoted to the position of principal assistant engineer in 1913; and was acting chief engineer since December, 1913. Prior to his service with the commission he had been with the Western Pacific Railway Company, the Southern Pacific Company and the United States Reclamation Service.

John W. Graham of Twin Falls, Idaho, will fill the vacancy left on the Idaho public utilities commission by the recent resignation of Judge D. W. Standrod. Mr. Graham has been practicing law in Idaho for the past four years. He is 41 years of age and a native of Canada, but was educated at the University of Nebraska. He practiced his profession in Fremont, Dodge County, Neb., and was for four years prose-

cuting attorney of that county, and had altogether 15 years' experience as a lawyer. The appointment which he has just accepted will hold until four years from the first Monday of January, 1915, since Judge Standrod held the long term on the utilities commission.

MEETING NOTICES.

Oregon Irrigation Congress.

The fourth annual session of the Oregon Irrigation Congress will be held at Imperial hotel, Portland, on January 7, 8 and 9, 1915.

San Francisco Section A. S. M. E.

A meeting of the American Society of Mechanical Engineers will be held at the Engineers' Club. Hotel Sutter, San Francisco, 8 p. m., Dec. 8. Mr. A. H. Babcock will present a paper on "A Novel Method of Handling Boilers to Prevent Scale and Corrosion."

Electrical Contractors' Association.

The Electrical Contractors' Association of Oregon has called a convention to meet at Albany, Oregon, December 9, and invites all members of state and local associations to be present. The purpose is to consolidate all such associations in one state organization which shall be affiliated with the national association of electrical contractors.

Utah Society of Engineers.

The Utah Society of Engineers held its monthly meeting Friday, November 20th, at Salt Lake City. The feature of the occasion was the reading, by State Engineer W. D. Beers of a paper on the history of water legislation in Utah. From the standpoint of an administrator he pointed out the defects of the present law. He suggested that a commission composed of representatives from varied interests and professions which have to deal with water in its manifold uses, be created by the legislature to study conditions, and make recommendations to the incoming legislature. The speaker said that titles to land at present were reasonably secure, but titles to water are indefinite and insecure.

Assistant State Engineer C. J. Ullrich commented on the administrative difficulties of the state engineer's office in dealing with water questions. Guy Sterling called attention to the need of further study of the proper amount of water for the various crops. Horace W. Shelly exhibited maps of irrigated lands near Monticello, Utah, where water rights are in course of arbitration. A committee to advocate needed legislation was appointed. It consists of Horace W. Shelly, chairman, Dr. Joseph F. Merrill, F. W. Moore, and O. W. Ott, to act in city, county and state matters. City Engineer Sylvester Q. Cannon presided at the meeting.

Oregon Society of Engineers.

The regular Monday luncheon of the Oregon Society of Engineers, held November 23rd, at the Benson Hotel, was presided over by Mr. W. H. Crawford, manager Portland branch Chas. C. Moore & Company, Engineers. The speaker of the day was Mr. John F. Carroll, editor-in-chief of the Evening Telegram. His subject was "A Note of Optimism." Mr. Carroll said that he could not see why any one should have any other perspective except an optimistic one, in the United States. He said "hard times" should be considered the best thing than can happen to a country and an individual, as it brought out their powers and resources and only a coward would "lay down" and lament his fate.

The Jovian Electrical League of Southern California.

The weekly luncheon of the league, held at Christopher's, Los Angeles, on Wednesday, November 25th, was attended by about 125 Jovians and a number of visitors. A letter from Jupiter Niesz was read in which he speaks in glowing terms of last year's record of the league and urges the officers on to even greater efforts. A course of free lectures on alternating currents at the Polytechnic High School was announced by Mr. Rogan. A splendid musical program was provided by

C. H. P. Dellman, the chairman of the day. Then followed three breezy three-minute talks by H. B. Lynch on S. J. Keese of the Westinghouse Company, R. H. Manahan on E. R. Northmore of the Los Angeles Gas and Electric Corporation, and J. E. Barker on T. E. Burger of the Western Electric Company. A large iron cross, presented to Tribune Pieper during the early part of the luncheon, was transferred by him several times during the progress of these little talks. A splendid lecture was then delivered by Judge Thos. P. White on "The Woman's Court and Humane Justice." As the originator of the Woman's Court, the Judge was in a position to not only present many arguments in its favor, but he pointed out its numerous beneficent effects in the past on offending women and children. He dwelt on the importance of the police courts and the human responsibility of the police judge, who comes in contact daily with first and frequently petty offenders. How he should, in many cases, supplant parenthood and rather guide than sentence, appealing to a prisoner's intellect and his or her desire to do what is right if the right course is pointed out to him or her. The main questions to place before ourselves are: "Who are we, what are we, and whither are we going?" After listening to the Judge's strong appeal for greater police protection for Los Angeles, the league recommended the subject for action to its newly appointed Civic Committee.

California Association of Electrical Contractors.

When the California Association of Electrical Contractors and Dealers completed its new by-laws the conclusion was reached that the meetings were too far apart to obtain the proper co-operative effort, and the getting together of the contractors throughout the state. As the result, it was decided to hold quarterly meetings; two in the northern part of the state and two in the southern part of the state each year. The first quarterly meeting of the sixth year was held at Los Angeles, California, November 13, 1914, at Christopher's Cafe. Members from all parts of the state gathered at Los Angeles, and a most enthusiastic meeting lasting for two days was held.

The first day consisted of the meeting of the executive committee, at which the financial affairs of the association were considered. On the next day the entire association met, and reports from the Standardization, Compensation Insurance, Architects, State License, and Segregation Committees were taken up and acted on. The report of the secretary showed that the association had a steady growth the past quarter; twenty members being added to the list. The next quarterly meeting will be held at Oakland, California, just previous to the opening of the Panama-Pacific Exposition.

The open meeting was called to order November 14th, by J. C. Rendler, president of the Los Angeles Section. Mr. Rendler, in a few remarks of welcome, introduced Mr. Spring, of the Western Electric Company, who read the paper on "Co-Operation" as prepared by the joint committee of Jobbers and Contractors. Mr. Rendler stated this paper represented the principles of the association and that if there was any individual present that was not in sympathy with this movement, that they had the privilege of retiring. There were a large gathering consisting of jobbers, manufacturers, and contractors present and it was gratifying that all remained.

Mr. Rendler then introduced as the speaker of the day W. L. Goodwin, vice-president and general salesmanager of the Pacific States Electric Company. Mr. Goodwin briefly outlined his views of the work of the association; what was expected to be accomplished by same, and how it could be accomplished. Questions were "fired" at him from all sides, which he carefully answered, in fact he was kept talking for nearly four hours.

Among those who made short talks and brought out Mr. Goodwin's points were Ralph Clapp, representing a manufacturer. Messrs. Rendler, Gilpin, Somers, Boynton, Schnei-

der, Foulkes, Gribble and Arbogast, representing the contractors, and Mr. Burger and Mr. Reynolds representing jobbers. Among the visitors present who came from the northern part of the state were Messrs. Goodwin, Alvord, Gregory and Steele.

While it had been planned that there would be no regular entertainment at this convention, still the visitors were royally entertained by the members in the south. On Friday evening, November 13th, Mr. Alvord of the General Electric Company, gave a dinner in the Bristol Cafe. After dinner under the guidance of Mr. J. C. Rendler, an auto trip was made to Venice and dancing was enjoyed until the wee hours of the morning. Saturday noon a luncheon was given by the Los Angeles Contractors and their local meeting was held immediately after.

This meeting was one of the best ever held in the southern part of the state, and the reports of the different committees, who were actively at work, were well worth listening to, as they showed that the work outlined by the state association could accomplish great things for local associations when the local members showed a willingness to work. Saturday evening the contractors were entertained at dinner at the Jonathan Club by Messrs. Foulkes and Arbogast. Sunday was spent in an auto trip throughout the different parts of Los Angeles.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Oakland, Antioch & Eastern Railway has filed an application with the commission requesting authority to renew certain promissory notes amounting to \$295,345.28.

The city of Los Angeles has filed an application with the commission, asking that the commission fix a price to be paid by the city of Los Angeles for the distributing system of the Southern California Edison Company within the city limits of Los Angeles and in certain adjoining territory. The city of Los Angeles proposes to acquire the distributing system of the Southern California Edison Company to be used for the distribution of the hydroelectric power which the municipality will develop in connection with its aqueduct. The city authorities propose to acquire the distribution system by condemnation, and in contemplation of this procedure, the city has asked the commission to fix the compensation to be paid for the properties to be taken over.

The Rodeo Land & Water Company of Beverly Hills, Los Angeles county, has filed an application with the commission requesting authority to sell its water, gas and electric systems to the Beverly Hills Utilities Company in return for \$200,000 capital stock of the latter company.

The commission has rendered a decision denying the application of the Hawthorne Electric & Water Company, Los Angeles county, to issue \$18,000 of stock and a sufficient amount of 5 per cent bonds to refund \$32,570.33 of promissory notes.

The Western States Gas & Electric Company, operating in Stockton, Eureka and vicinity, has filed an application with the commission requesting authority to renew certain promissory notes amounting to \$45,000 held by H. M. Byllesby & Company.

The commission has rendered a decision authorizing the Pacific Electric Railway Company to issue \$2,942,000 of its refunding mortgage 50 year gold bonds at not less than 87½ per cent of face value and accrued interest. The company proposes to use the proceeds from the sale of these bonds in reimbursing its treasury for expenditures made for betterments and additions.

The Central California Gas Company has filed an application with the commission requesting authority to issue \$8000 of its bonds at not less than 90, and \$8800 of its common capital stock at 80. The company proposes to use the proceeds from the sale of these securities in defraying the cost of additions to its plant and distributing system.

NEWS OF IDAHO PUBLIC SERVICE COMMISSION.

In special session held Thursday, November 19th, the Boise council passed resolutions addressed to the public utilities commission asking that no undue burden of expense be put upon the electric companies operating in Boise in connection with the building, maintenance or extension of the transmission or distributing systems.

These resolutions come as a result of the informal conference on the matter held by members of the council on Wednesday afternoon, when it was shown to them that the telephone company had made application to the public utilities commission to compel the electric companies, wherever their lines carrying 5000 or more voltage, crossed above or under the wires of the telephone company, to either place their wires in an underground conduit or to insulate them as to thoroughly protect the wires of the telephone company.

The resolutions further ask that the public utilities commission show no more favor to the telephone company than that accorded the electric companies, and the mayor of the city is authorized to attend the forthcoming hearing of the commission and to present a copy of the resolution at that hearing.

The Idaho Public Utilities Commission has entered an order lowering the light rates of the Washington Water Power Company in several northern Idaho towns. The new rates will be as follows: First eight kw. hours per month or less, \$1.00; next 12 kw. hours per month, 11 cents; next 10 kw. hours per month, 10 cents; all over 30 kw. hours per month, 8 cents.

Rates which the company asserts are reductions from the present ones have been filed with the commission by the Pacific Telephone & Telegraph Company for its telephone service. They did not fully comply with the rules of the commission, so were returned for completion. As expressed by the letter which accompanies the schedules, the company has 650 one-way routes in the state. Of these the rate on 498 is decreased; 142 are unchanged, and 10 are increased. The decreases range from 5 to 20c for the initial period, and the increases are 5c. There appears to be a qualification to the statement that the company's rates are decreased, however. This lies in the fact that, although there is a decrease in the rate for the initial period, there is also a decrease in the time of the initial period, which appears to make the rate higher. For instance, where in the past the rate for the initial period has been 25c, the period has been three minutes. Under the new rates, in some cases the rates are lowered to 10c, but the period is made one minute. Thus for the three minutes for which it was necessary to pay in the first instance the cost would not be 15c for the first minute and 10c each for the last two, making a total of 35c where in the past it has been but 25c. In some cases, however, the rates are lower, and if the conversation lasts but one minute, they are lowered in the number of cases which the company mentions.

BOOKS RECEIVED.

"Practical Lessons in Electricity," by Robert A. Millikan, Francis B. Crocker and John Mills; 318 pp.; 5½x8½ in. Published by American Technical Society, Chicago, and for sale by Technical Book Shop, San Francisco. Price \$1.50.

The fundamental facts of electricity are here presented in readable form. The book is divided into four distinct parts, elements of electricity and magnetism, direct current dynamos, elements of alternating currents and storage batteries. It is written primarily for self-instruction and for the practical worker, many illustrations and diagrams facilitating the study. Though written in semi-popular style, the statements are technically accurate. This feature, combined with the low price for a book of this magnitude, should make it of value to many workers and students.

TRADE NOTES.

The electrical contract for the new high school building being erected in Eugene, Oregon, has been awarded the Comet Electric Company of Eugene, Oregon.

The electrical contract on the new Eugene armory, being erected in Eugene, Oregon, has been awarded to the W. A. Kraner, Chamber of Commerce Building, Portland, Oregon.

The W. A. Kraner Company, Chamber of Commerce Building, Portland, Oregon, has received the electrical contract for the wiring of the warehouse on Municipal Dock No. 1, Portland, Oregon.

The contract for the construction of an ornamental lighting system on Fair Oaks avenue and the north side of Huntington drive, from Oneonta station to South Pasadena, has been let to the W. A. McNally Company of Pasadena for \$15,948.

The Ne Page, McKenny Company, Oregonian Building, Portland, has been awarded the contract for the electrical installation in the new Meier & Frank Company's building being erected in Portland, Oregon. This is a department store building and the value of the contract is approximately \$45,000.

John Mullen, a veteran miner of the Park City district, and associates of Salt Lake, have practically completed arrangements for the installation of an electric hoist on his Altmore property, three miles west of Springdale, in Nye county, Nevada. Mr. Mullen has been using a windlass and the present depth of the shaft makes it practically impossible to proceed further with that method of hoisting. A contract has been entered into with the power company at Bishop for the necessary electric power. Shipments are to be started as soon as the work of installing the hoist has been completed.

PUBLICATIONS RECEIVED.

"Fifth Annual Report of the Board of Supervising Engineers, Chicago Traction," 267 pp., 6x9 in., comprises the final report of Bion J. Arnold, the chief engineer of the rehabilitation work authorized by the traction ordinances of 1907. Results are summarized and analyzed, and valuable details are given of construction and operation.

"Industrial Gas Calorimetry," Technologic Paper No. 36, from U. S. Bureau of Standards, by C. W. Weidner and E. F. Mueller, 150 pp., 7x10 in., gives details of tests on nine types of gas calorimeters, furnishing gas engineers, public service commissions and gas inspectors exact information as to the accuracy obtainable with the instruments, the sources of error and precautions to be used.

The U. S. Bureau of Standards have published several new scientific papers. No. 227 is concerned with "Measurements on Standards of Radiation in Absolute Value," by W. W. Coblenz. No. 228 is an "Experimental Study of the Koepsel Permeameter," by C. W. Barrows. No. 229 describes "Various Modifications of Bismuth-Silver Thermopiles Having a Continuous Absorbing Surface," by W. W. Coblenz.

The Bureau of Standards' Technologic Paper No. 41 by R. S. McBride and J. D. Edwards deals with "The Lead Acetate Test for Hydrogen Sulphide in Gas." The effect of the following factors upon the results obtained in tests for the detection of hydrogen sulphide in gas by the lead acetate test have been investigated: (1) The paper: Kind; method of its preparation, including the strength of lead acetate solution used; and the moisture content when used. (2) The gas: Its humidity, and the period and rate of flow. (3) The apparatus: Its form and size, as determining the circulation of gas with respect to the paper. The conclusions reached in regard to the effect of these various factors are given in full. A single apparatus for carrying out the test is described and specifications for carrying out the test in such a way that the results will be of quantitative significance are given.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell, Secretary-Treasurer, 814 Scott, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correlate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

Members of the association and others desiring to suggest changes in the National Electrical Code through the C. A. E. I. should forward same to secretary before January 1, 1915.

The C. A. E. I. met in Council Chambers, City Hall, Berkeley, Saturday, November 28th. The discussion was on desired changes in the Code. The chief result of the meeting was a resolution requesting that the Code Committee use every reasonable effort to group and condense the rules on wiring of buildings. A few of the many conditions on which this resolution is based follow:

The provisions for service wiring from overhead lines are contained in rule 12 for outside work.

The provisions for knob and tube work are contained in rules 16 and 26.

The provisions for switches and cut-outs are contained in rules 19, 23 and 24.

The rules for metallic armor systems contain many similar provisions which could be generalized.

The provisions requiring metal cabinets with conduit, armored cable and metal moulding systems is contained in the material section of the Code, i. e., No. 70, Class D.

Experience shows that electrical men, usually able to keep well informed on the many other subjects pertaining to their business, are unable to maintain an accurate knowledge of the Code and also that many wrong impressions are formed through failure to read all rules on certain points. The general situation is like the first reader story of an elephant and six blind men. Each blind man carefully inspected that portion of the elephant's anatomy which was nearest him. Each received a different impression of what an elephant was like. Because all had first-hand information each was very certain that his impression was correct. It wasn't the fault of the men, because they could not see. The elephant was all there, but it was hard to find all of him. Of course the comparison must not be taken too literally, as there are few blind men in the electrical industry.

Were the Code more condensed and made more convenient for reference, most of the unintentional violations of rules (a large percentage of the total infractions) would be avoided; fox-like, minimum requirement contractors would have less opportunity to misconstrue rules; book-worm inspectors would have less lee-way to combine technical phrases into dogmatic enigmas, and the need of special installation rules would be reduced.

NEW CATALOGUES.

Wagner Electric Manufacturing Company is distributing two striking pamphlets giving pertinent facts and illustrating the economy of Wagner single-phase motors.

"An Electrical Xmas" is the subject of an interesting pamphlet being distributed by the Western Electric Company and giving suggestions for electrical gifts.

Cutler-Hammer Manufacturing Company of Milwaukee, Wis., are distributing an interesting booklet about Electrical Equipment for the Theater, particular attention being given to light dimmers and motor controllers.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently issued the following publications: Folder 4287—"Westinghouse Electric Drive for Flour Mills." This little publication describes the use of electric power in flour mills, showing curves illustrating the energy used in mills of various kinds throughout typical days of operation. The equipment used for different mills is also given. Folder 4152 illustrates and describes the Westinghouse Sewing Machine Motor, its application and operation. Numerous views are shown illustrating the method of attaching the motor to different types of machines. Folder 4286—"Westinghouse Insulating Tapes"—describes briefly the different classes of friction tape, armature tape, and splicing compounds that are furnished by the company.

The General Electric Company has issued Bulletin No. 48015 illustrating and describing its Type M. Transformer for Operating Electric Stop-Motion of Textile Machinery. Bulletin No. 41500, describes that company's Small Direct and Alternating Current Motors of the Drawn Shell Type. These motors range in capacity from 1/30 to 1/4 h.p., inclusive. Bulletin No. 44404, describes the new line of Ventilated Commutating Pole Motors. This motor has a rated capacity of 80 h.p. on 600 volts, but, due to the special feature of induced ventilation, has a greater service capacity than motors of the closed type having the same hourly rating. A description of the motors is given in more or less condensed form, but a more detailed description is given in the company's bulletin A-4171. The new bulletin contains a schedule of speed tables and characteristic curves of the motor. No. 40500 is devoted to the subject of Alternating Current Generators for Direct Connection to Reciprocating Engines. The object of the bulletin is to illustrate and describe some of the recent improvements in the alternators built by the company for direct connection to steam, oil and gas engines. The construction of the alternator is illustrated and described in considerable detail, and the bulletin contains data relative to dimensions, capacities, weights, etc., of alternators of this description.

The General Electric Company has just issued an attractive illustrated bulletin devoted to Modern Electric Railway Apparatus. The bulletin is contained in a colored cover of artistic design, and describes, briefly, the Curtis steam turbine for railway service, railway generator, transformers, switchboards, synchronous converters, motor-generator sets, G-E ventilated railway motors, electric locomotives, and contains illustrations of the G-E locomotives, in use at the locks of the Panama Canal. The number of the bulletin is 44003. Bulletin No. 44300 illustrates and describes some of the Gas-Electric Motor Cars and Locomotives built by the company. The power equipment is described in considerable detail in the bulletin and average cost of operation of the standard car is given, in addition to other data relative to weights, dimensions, etc. Bulletins No. 44403 and 44405, describe Ventilated Commutating Pole Railway Motors for 600 and 600/1200 volt service. Bulletin 44403 is devoted to the GE-222-G Railway Motor which has a rated output of 140 h.p. at 600 volts, and, having modified windings, can be supplied for operation with two in series on 1200 volts, at which voltage the rating is 130 h.p. Bulletin 44405 describes the GE-233-A motor for operating two in series on 1200 volts. This has an hourly rating of 75 h.p. Bulletin No. 46018, which describes a Portable Voltmeter, known as Type P-8. This is an unusually small instrument inclosed in a mahogany case, and suitable for use on both alternating and direct current. The bulletin describes the instrument in considerable detail, and includes a reproduction of the scale in actual size.

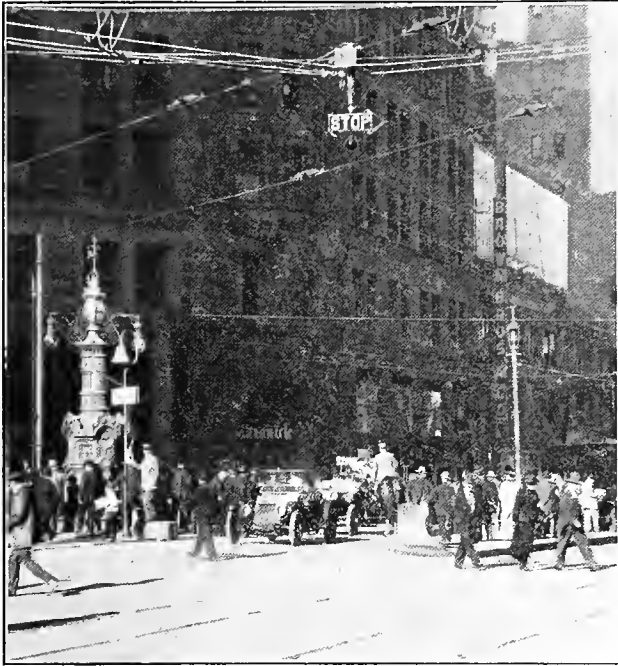


INDUSTRIAL



AN ELECTRIC TRAFFIC SEMAPHORE.

An electric traffic semaphore has recently been installed at Third and Market streets, San Francisco in an effort to solve traffic difficulties. It is operated by a policeman standing at the safety station. A mere pressing of a button turns



Electrically Operated Traffic Semaphore.

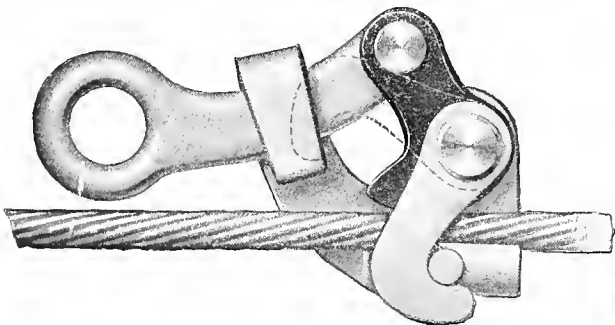
the arrow and rings one or two bells, as the case may require. The arrow is lighted at night and is also connected so as to continuously revolve and ring in case of a fire alarm, thus clearing the street.

The exhausting effect of the old system of blowing a whistle is well known and may be entirely eliminated by this system.

This is hung from above so as not to obstruct traffic. An automatic air whistle can be substituted for the bell if considered desirable. This is the invention of B. M. Harris of San Francisco and the mechanical details have been worked out by Geo. Blanchard of Busch Manufacturing Company of San Francisco.

A NEW CLAMP.

Mathias Klein & Sons, tool manufacturers, Chicago, has perfected and is now marketing an improved Klein Haven's clamp adapted for handling plain or stranded wire or cables up to $\frac{3}{4}$ in. in diameter. The particular feature of construction is the addition of a swing latch which engages with

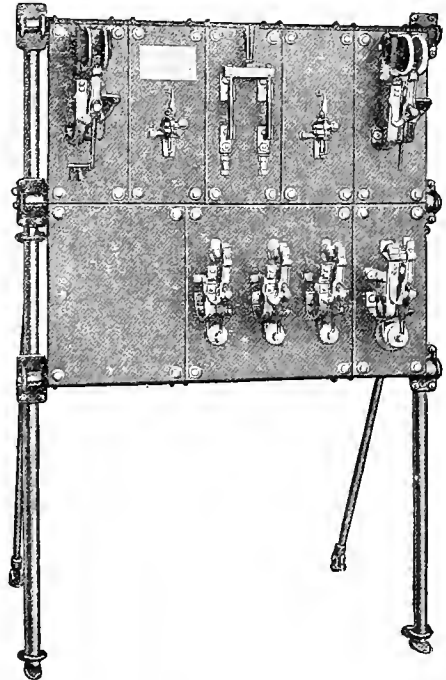


A New Clamp.

stud on the lower jaw, thus centralizing the pressure, on the cross-bolt which is strongly made of turned machined steel. The body and handle of the clamp are made of steel forging and the eccentric of hardened tool steel. This tool is the outgrowth of a demand for a clamp to accommodate larger than $\frac{1}{2}$ in. cable.

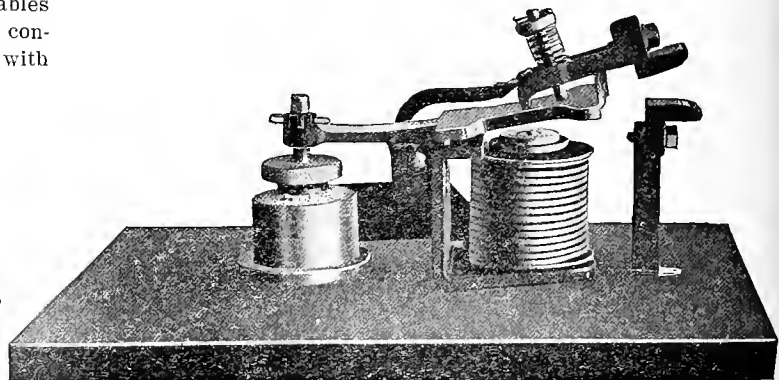
NEW AUTOMATIC PRESSURE REGULATOR FOR STARTING AND STOPPING SMALL MOTORS.

The double-pole diaphragm type pressure regulator illustrated below is a new device for automatically controlling small direct or alternating current motors operating on pres-



Switchboard Upon Which Pressure Regulator Is Mounted.

sure systems. This regulator stops the motor when the maximum pressure desired is reached and starts it again when the pressure drops to the low value for which it is set. For capacities within the limits for which it is designed (1 h.p. for d.c. and 5 h.p. for a.c. motors) this regulator controls the operation of the motor without an additional magnetic switch and automatically maintains pressure in the system between given limits. It is made by The Cutler-Hammer Manufacturing Company of Milwaukee.



Detail of Automatic Pressure Regulator.



NEWS NOTES



INCORPORATIONS.

FOX, ORE.—A Joint Stock Telephone Company has been organized for the construction of a telephone line between Beech Creek and Fox. T. S. Kirkpatrick is president; W. H. Shank, treasurer; John Hiatt, secretary.

SEATTLE, WASH.—The Electric Fixture & Construction Company has been incorporated at Seattle, with a capitalization of \$3,500, by T. J. Madlen and R. K. Le Grand. A. S. Hansen, Leary Building, is attorney.

VANCOUVER, WASH.—Articles of incorporation have been filed with the county auditor for the Hayes-Etna Telephone Company with a capital stock of \$3600. The company contemplates constructing and operating a telephone line between Hayes and Etna.

SPOKANE, WASH.—Malloy Prairie Telephone & Telegraph Company has been formed at Medical Lake, with a capitalization of \$1000, by W. E. Wood, Joseph Tucker, J. W. Ward, C. E. Svenson and J. W. Goodykoontz. John Salisbury, 503 Rookery, Spokane, is attorney.

MALTA, MONT.—Articles of incorporation have been filed by the Malta Light Company to carry on business of electricians, electrical engineers and dealers in electricity and electric motive power for lighting, heating, etc.; \$10,000 is the capital stock. John Shady, R. J. McCreary, B. M. Phillips and others, are directors.

FINANCIAL.

OAKLAND, CAL.—A plan for meeting the financial requirements of the Oakland, Antioch & Eastern Railroad during the next three years is embodied in a letter being circulated among security holders of the company. The plan involves a three year note issue, secured by bonds, two for one, and paying 6 per cent interest, semi-annually. The stockholders, if the plan becomes effective, agree to pay in \$3 per share over a period of a year and one-half in place of the \$1.50 assessment falling due in January, and to be secured by notes of the above issue for equal amount. The bondholders agree to receive for their interest, as their coupons mature, notes of the above issue, to the amount receivable by them, in equal amount to the sum total of their coupons as they mature. The company has the privilege of selling the bonds held as security for these notes at not less than 80 and distributing to the noteholders the proceeds.

OAKLAND, CAL.—A permanent reorganization committee has been appointed to put into effect plans for refinancing the Peoples Water Company. The committee consists of C. O. G. Miller, F. W. Van Sicklen, Percy T. Morgan, John A. Hooper, E. J. McCutcheon, P. E. Bowles, W. W. Garthwaite and John S. Drum. The plan agreed upon at a conference between the several committees and the security holders is a modification of the so-called Drum plan. Under the new plan the proposed bond issue will be \$12,000,000 instead of \$12,500,000, and the new bonds will be issued at par instead of 95, drawing interest at 6 per cent instead of 5 per cent. The bonds are to be callable during the first ten years on one year's notice at 100 instead of 102½. The July coupons on the \$5,600,000 underlying bonds and also the coupons maturing next January will be payable in cash. People's Water bonds will be exchangeable for 11 shares of new stock instead of 10½ shares, and People's preferred will be exchangeable for new common on the basis of 5 for 1 instead of 8 for 1; \$100,000 of the new common stock will be turned over to the holders of the old common stock in exchange for their interest.

SAN FRANCISCO, CAL.—An audit of the books of the San Francisco-Oakland Terminal Railways which is now in control of the holders of its collateral notes, has been completed by Price, Waterhouse & Company. The figures are for the year ended June 30, 1914. Gross earnings were found to be \$4,515,798, with operating expenses of \$2,929,920 and net earnings of \$1,472,841, including \$125,963 of miscellaneous income. Interest charges on bonds and notes aggregated \$1,057,499 and discount on notes sold was \$10,491, leaving net profit for the year \$404,950. If interest of \$240,101 charged to capital account on construction in progress is included the balance carried to surplus account for the year was \$644,952. In the year \$510,927 was charged to capital account for road and \$105,922 for equipment, making total capital expenditures \$616,850. This was after considerable writing down of land values and charging off of abandoned structures. The total amount of bonds outstanding as of June 30 was \$16,656,000 in the hands of the public and \$3,256,000 pledged as security for the Oakland Railway notes, a total of \$19,912,000. Net profits from operation for the year, after charging off all interest, including interest properly chargeable to capital account, does not provide for sinking fund payments. It appears, therefore, that while the company is amply able to maintain itself in excellent operating condition it is not in position to undertake new construction without new capital. Maintenance charges appear to be ample, as \$400,972 for maintenance of structures and \$284,080 for maintenance of equipment, were charged against operating expenses in the year.

ILLUMINATION.

STITES, IDAHO.—H. D. Millard has been granted the right to install a system for the distribution of electric power in this village.

GLENDALE, CAL.—An ornamental lighting petition has been signed by property owners on Brand boulevard from Colorado street to the south city limits.

HEBER, CAL.—The Commercial Club has awarded the Imperial Valley Improvement Company the contract for the installation of electric lights on Main street.

RIVERSIDE, WASH.—J. R. Morris of the Riverside Lumber & Box Company, has made a tentative application to the council for a franchise for an electric lighting system.

HEMET, CAL.—The city council has awarded the Southern Sierras Power Company contract for installing a new street lighting system, construction work to be started immediately.

UNION, ORE.—The city authorities have signed a five year contract with the Eastern Oregon Light & Power Company for a better street lighting system. The new plan calls for the immediate installing of larger lights and improved distribution.

BERKELEY, CAL.—The council has ordered electroliers for University avenue from Grove to Third street and on Bancroft way from College avenue to Piedmont avenue. Lights on College avenue from the university campus to the city line are being considered.

SEATTLE, WASH.—The city council has ordered the improvement of Madison street and others by the installation of a system of cluster lights along the curb line on each side, together with the installation of poles, conduits wires and other necessary apparatus, according to plans prepared by the city engineer.

LOS ANGELES, CAL.—The Board of Public Utilities has approved the agreement reached between householders of Herman and the Los Angeles Gas & Electric Corporation, whereby the corporation is to extend its gas mains at the first of the year on Walnut Hill avenue, Isleta street, Kendall avenue and Redfield avenue.

SAN FRANCISCO, CAL.—The supervisors' street lighting committee has come to a satisfactory understanding with Fourth street property owners regarding the lighting of that thoroughfare. Property owners are to furnish the electroliers and the city will furnish the current. There are to be four lights at corners where transfer points exist. Altogether there are to be 48 of these lights.

BRIGHAM CITY, UTAH.—The town of Mantua has been connected up with the Brigham City electric light plant and now enjoys the conveniences of a modern lighting system. The proposition has long been under consideration on the part of the people of Mantua and an election held last year authorized the town board to sell town bonds in the sum of \$3000 with which to build a distributing system, having previously been assured that power could be purchased from Brigham City.

SALT LAKE CITY, UTAH.—If the city commission has its way in its present franchise negotiations with the Utah Light & Traction Company transfers will have to be issued to passengers on the street railway system at any time the passenger makes request for one while he is on the car. That the present rule of refusing transfers except at the time the fare is paid should be abolished, the commission agreed recently. Such a clause will go into the amended franchise being considered. The commission also decided to insert in the franchise a provision eliminating the minimum charge now prevailing for retail lighting current, believing that the consumer should pay for just the current used. The advisability of providing for an examination of the company's books once a year by experts engaged by the city to determine the reasonableness of rates also was discussed and may be included in the franchise. After the commission has completed a draft of the franchise the company will be asked to appear and present whatever objections it may have. It is considered certain that the company will protect some of the provisions, though it has already agreed to the rate reductions heretofore announced.

TRANSMISSION.

ALBUQUERQUE, N. M.—The third application for a power site made by Col. John Borrodaile of this city, representing the White Rock Canyon Hydroelectric Company, which plans to develop power in White Rock Canyon and transmit same to Santa Fe, Albuquerque and Las Vegas, has been approved by State Engineer James A. French. The company will decide on one of the three approved sites, and has six months in which to file plans for its proposed hydroelectric plant.

VANCOUVER, WASH.—J. H. Cunningham has filed notice with the county auditor of the appropriation of 500 cubic feet per second of the water of the east fork of the Lewis river. As stated in the notice filed, the water is to be used for hydraulic and electric power for municipal lighting, manufacturing and other commercial purposes. It is not known whether the development will take place immediately or not.

NORTH YAKIMA, WASH.—An ordinance has been passed granting to the Yakima Central Heating Company the franchise to maintain poles, wires and conduits for the transmission of electricity for lighting, heating and other purposes.

EUREKA, UTAH.—Some extensive improvements are being made here in Tintic by the Utah Power Company, between 40 and 50 men being employed on this work. In addition to the construction and equipment of a new substation, new lines are being erected to various parts of the Tintic district; and in Eureka an entirely new system of street lighting is being installed. There is considerable work con-

nected with the installation of these new street lights it being necessary to put new cross-arms on many of the poles and to replace some of the older and lighter poles in various parts of the camp.

TRANSPORTATION.

BENICIA, CAL.—The A. D. Bowen Company has announced that work will soon be begun on the electric railroad from Benicia to Vallejo.

PLENTYWOOD, MONT.—Business men propose the question of the construction of an electric railroad from Plentywood to Raymond to connect with the Soo line.

OGDEN, UTAH.—Every preparation is being made by the Ogden, Logan & Idaho Railway Company for the extension of its electric line from Idlewild, the present Ogden canyon terminus, to Huntsville.

FRESNO, CAL.—The Fresno Interurban Railway Company has formulated a new plan for financing its proposed 26 miles of railroad, one branch of which will run from Fresno to the Centerville citrus district and the other from Fresno to the Clovis and Gault colony.

SAN FRANCISCO, CAL.—A resolution presented to the supervisors calling on the city engineer to report a plan whereby the congestion of street car traffic in the city may be relieved, with special consideration of the building of municipal car tracks on Market street from Eleventh to Kearny. The resolution has been referred to the committee on public utilities.

STOCKTON, CAL.—Negotiations are pending by which portions of the city lines of the Central California Traction Company will be abandoned and a universal transfer privilege established between the Traction line and the Stockton Electric Railway Company. It is understood that the Traction line out north San Joaquin street which parallels both the California and the El Dorado street car lines of the old company has never been a paying proposition and that this line will be abandoned on San Joaquin street and on Vine street between San Joaquin and El Dorado streets. Another portion of the Traction line to be abandoned according to the report is a strip on Park street and the terminus on Center street. The Traction line will retain its interurban system and a strip of its Center street line, its Weber avenue line, its Pilgrim street service, and the strip on Vine street west of El Dorado and extending to Madison street.

TELEPHONE AND TELEGRAPH.

YERINGTON, NEV.—The Bell Telephone Company has been granted a franchise here.

TACOMA, WASH.—The new Auburn substation of the Pacific Coast Telephone & Telegraph Company was opened last week.

FERNDALE, WASH.—The Farmers' Mutual Telephone Company will start work at once on placing wires leading to new central station underground.

ALAMEDA, CAL.—The Pacific Telephone & Telegraph Company has applied for a 41-year franchise in this city. Sealed bids will be received by the council for such a franchise up to December 22d.

SAN FRANCISCO, CAL.—Bids closed December 1st for constructing frame telephone pay stations in Education, Horticulture, Food Products, California, Agriculture, Liberal Arts, Transportation, Varied Industries, Machinery Hall and Mines Buildings in the Exposition Grounds.

SEATTLE, WASH.—Telephone service has been established between the ships of the Pacific Coast Steamship Company in port here and the city lines. This is the first passenger line in the history of the harbor to have telephone connection with the city lines. The only other vessels similarly equipped here are the transport Dix and the cableship Burnside, which have telephone systems connecting with the quartermaster department when they are docked at Pier 11.

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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VOL. XXXIII NO. 24

SAN FRANCISCO DECEMBER 12, 1914

PER COPY, 25 CENTS

NEW PORTLAND STATION OF A. D. T. COMPANY.
BY C. M. MARRON.

MUNICIPAL OWNERSHIP OF HYDROELECTRIC
POWER PLANTS.
BY H. HOMBERGER.

FUEL OIL BURNING.
BY F. B. DUNN.

FIGURING PROFITS FOR THE ELECTRICAL CON-
TRACTOR.

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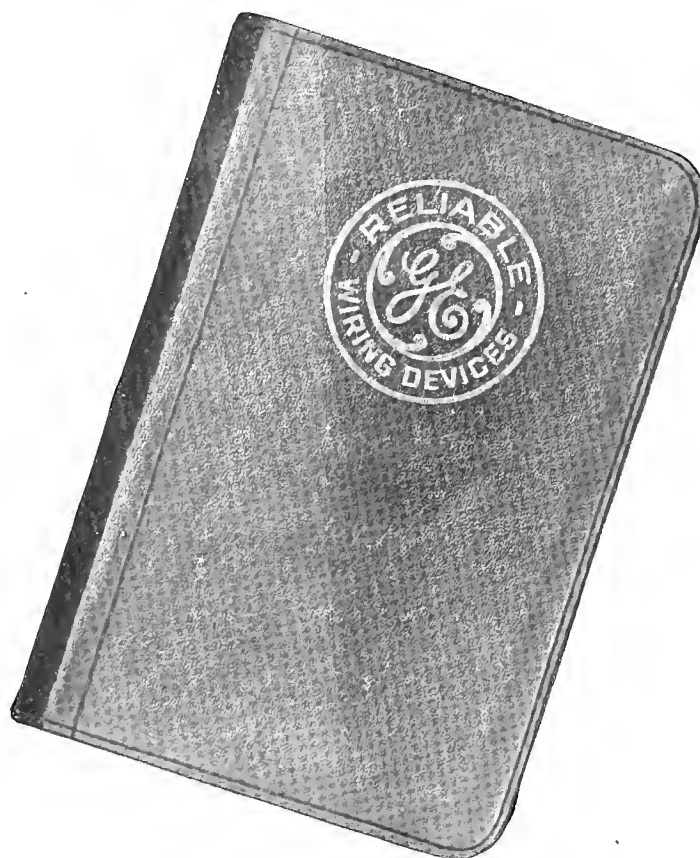
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The Okonite Co.

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I am the new pocket size

G-E Specialties Catalogue

I have been sent forth to be your helper.

That you may always have me with you in the store or on the job, I have been made to fit into a vest pocket.

Mr. Contractor and Mr. Dealer both say, "they have in me a most efficient assistant; my graphic way of illustrating wiring diagrams and specialty devices, is just what they have long wanted."

You have experienced the same need. You can overcome it if you will just drop a line and say you want me.

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Member Society for Electrical Development—"DO IT ELECTRICALLY"



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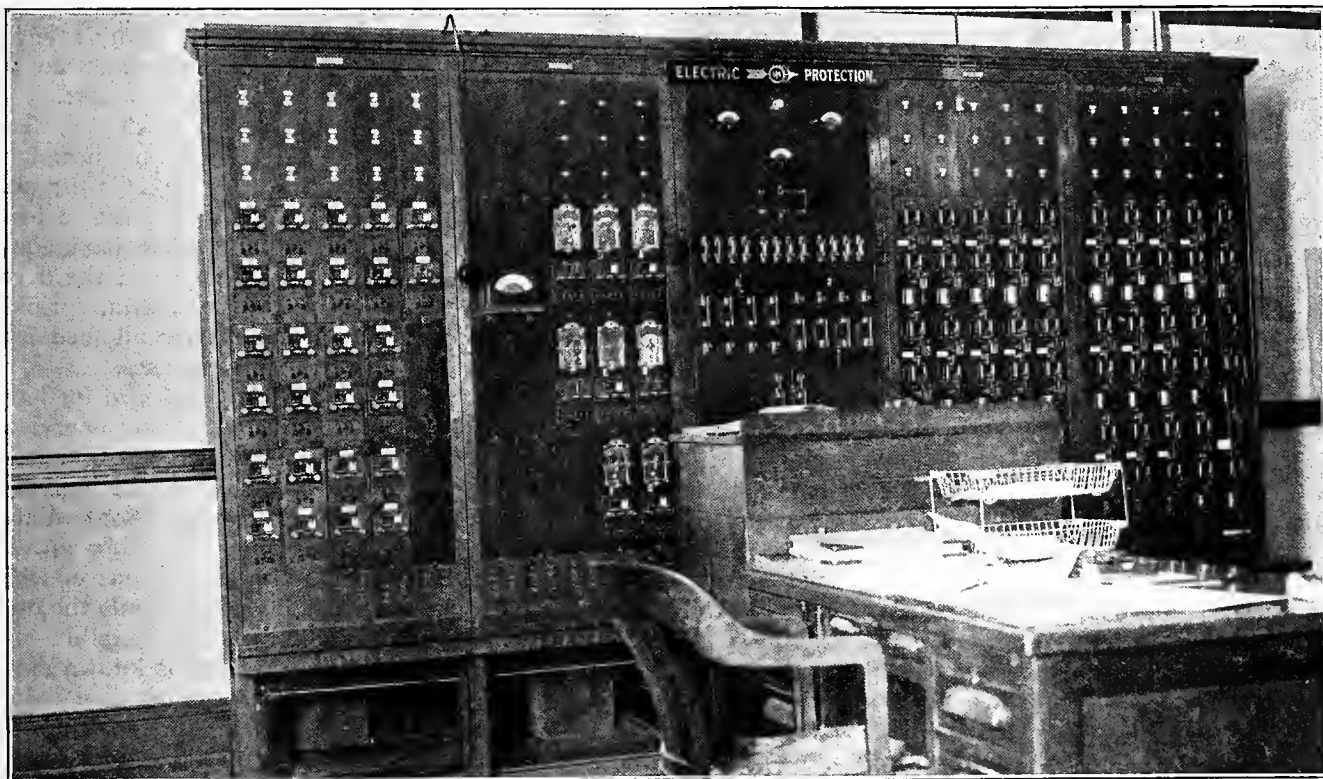
NEW PORTLAND STATION OF A. D. T. COMPANY

BY C. M. MARRON.

The American District Telegraph Company has recently completed the installation of a Class "A" central station on the second floor of the Lumbermen's Building, a reinforced concrete building at the north-east corner of Fifth and Stark streets, Portland, Ore.

extensions to the present switchboard and table facilities in anticipation of future growth.

About four years ago the company installed an entirely new office, including switchboards, tables, batteries, etc., in the Worcester Building, which was then



Switchboard of American District Telephone Co., at Portland, Oregon.

A space approximately 40 by 40 feet square, with light-wells on either side, has been leased for a term of years, and no expense has been spared in fitting these quarters up for a first-class signal office.

The concrete floors were trenched and conduits laid for all cables, power feeds, telephones, fire alarm transmitters, and all other devices pertaining to the service, convenient pockets being provided with brass plate covers for the purpose of easy access to the conduits, either for extensions or otherwise, the conduits being run in such a manner as to provide for future

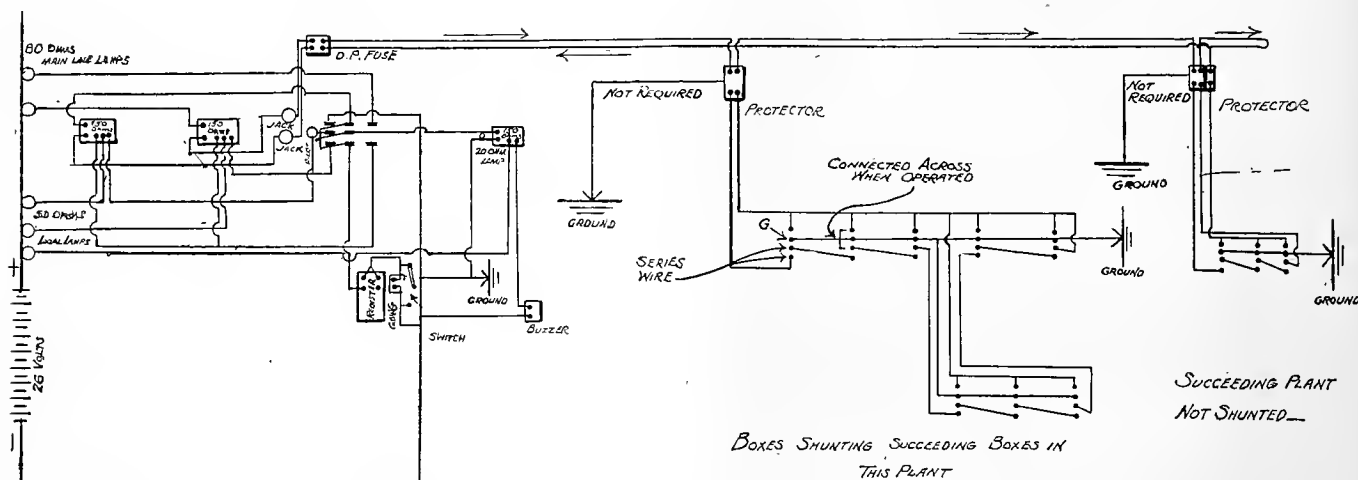
believed would take care of its service for about six years, but it was found that Portland's rapid growth was under-estimated and the quarters were found to be inadequate to the demands of the service.

The present switchboard frames are made of steel with pressed steel cornices, and trimmings, all of which are finished to represent golden oak. The boards are made up on the sectional plan, each section being of uniform width, height and depth, and all inter-changeable and capable of being adapted to any class of instruments. Each section is so con-

structed that a certain number of instrument units fit snugly into the frames, and are locked together with finished hexagon nuts on the front, so that when all instrument units are in place it appears as one large slate panel.

two banks of 21 cells, each giving a potential of 42 volts with 60 ampere hour capacity.

The battery being in duplicate and of sufficient capacity to carry the maximum load for a little over 90 hours, is connected to this charging panel, where it



Wiring Diagram of A. D. T. System.

The instrument units are all $14\frac{1}{2}$ by 5 in., being made of asbestos wood, on which are mounted the various devices for the different services. In the burglar alarm service, the top unit takes care of all the resistance units and pilot lights for the first vertical panel, the first vertical panel consisting of three units, each of which carries two relay drops each serving one burglar alarm line, the line being fed from the storage battery plant to the top or resistance unit, and after passing through suitable resistance, to the relay drop, and thence out through the underground cable to the subscribers' premises, where it is wired into all windows, doors or other openings, thence to a set of instruments consisting of polar relays, variable resistances, buzzers and other contrivances, all of which are adjusted and synchronized with the office instruments in such a manner that very little variation in resistance at the subscribers' premises, either by cutting in, cutting out, grounding or opening the line, will cause the alarm to sound at the office.

Each section of this new equipment is capable of taking care of thirty burglar alarm subscribers, or fifteen banks, the bank equipment being somewhat more elaborate, as two instruments are required to properly operate a bank vault equipment. In the store equipments a single line is used, which, after passing through all wiring, instruments, etc., is grounded at the premises, while in the case of a bank equipment, the line is brought back to the office and runs through a sensitive galvanometer with its arm so arranged that any deflection will cause the alarm to ring.

Two sections of the new switchboard are devoted to this service, one for store protection and one for banks, practically all of the banks of Portland being connected.

The center section of the board is occupied by a slate panel $1\frac{1}{2}$ in. thick by 25 in. wide and 65 in. high, all in one piece, on which are mounted the storage battery control. Everything in the office except the lights is worked from a storage battery plant consisting of

is charged with the 110-volt d.c. current from the Portland Railway, Light and Power Company's underground service, the rate of charge being under control with a variable rheostat and suitable ammeters.

The battery, when thrown to discharge, feeds three bus-bars, each giving different potentials and one opposite polarity, viz., 6 volts negative, 26 volts positive and 36 volts positive, the 26 volt positive being used for the burglar alarm lines, while the bank equipments takes both the 26 volt positive and the 6 volt negative. The night watch and fire alarm, sprinkler supervisory, and automatic fire alarms all feed from the 36 volt bus-bar through cartridge fuses.

Two sections of the board are equipped for handling night watch and fire alarm, sprinkler supervisory and automatic fire alarm service, the metal frames being identical to those already described, the individual units all being of the same material and same dimensions. The instruments, however, are different. In this service we use two 150 ohm relays, one of which is on the outgoing side of the loop line, while the other is on the return end, all circuits being metallic.

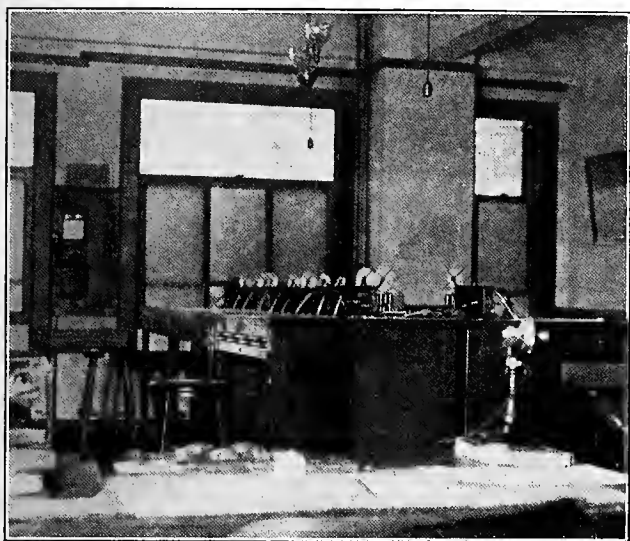
This service is operated on what is known as the McCulloch principle; that is, two relays of equal resistance work in unison when all things are normal. The battery is fed to the line from the storage battery through suitable fuses to the panel, at a potential of 36 volts, and is fed to the outgoing relay through a 700 ohm resistance unit, which allows approximately 25 mil-amperes to the line. This current passes through all the underground, aerial and interior wiring of all installations and comes back to the office, going direct to the other or "tail-end" relay and from there to the center point of a double-throw switch, which, when the circuit is not interrupted, is thrown to ground, completing the circuit, one end of the storage battery being grounded.

A second 700 ohm resistance unit is also provided from the same battery and potential which is fed to the other point of the double-throw switch, and in the

event of interruption either by an "open" or "ground" this switch is thrown to this point, which releases the ground and puts battery to the interruption through the "tail-end" relay, thereby making up what might be termed two circuits, both relays feeding out battery to the fault, whether it is an open circuit or a ground. As this switch is thrown to change this condition it also changes the local connections, so that both relays will now register their impulses on the tape. Under normal conditions, when the switch is thrown in its proper position for a closed and clear circuit, only one of the relays registers its impulses on the tape, while the second or "tail-end" relay operates its local to a pilot light, or rather to two pilot lights, one of which

back—each table having capacity for four double pen registers or eight circuits in all, with metal drawers in their relative proper positions for circuit records. The tables also mount pilot lights in their proper relative positions so that the operators taking signals from watchmen can watch the different circuits in addition to the operator in charge of the switchboard.

Fire alarms received over the system are transmitted to the fire department by means of a manual transmitter on a closed circuit, the circuit itself also being operated on the McCulloch principle. The transmitter can be set for any given number, and each and every installation is given a certain number just as a city street box, and is listed in the Fire Depart-



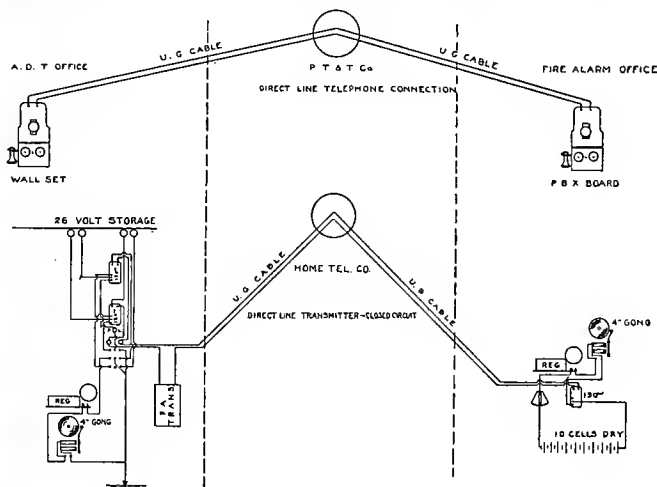
A. D. T. Timing Tables.

is mounted on the table where the signals are recorded, while the other is mounted on the switchboard at the top of the panel.

This circuit arrangement has many advantages, and has proven of great value in wire trouble, it being practically impossible to prevent signals from being received at the central station, except where both sides of the line are cut or grounded. In such rare cases only those boxes which are between the two faults are lost. Even a short on a loop does not cut out the signals. A grounded character wheel is used on each and every box, and should a loop become shorted out the signal would be distinctly heard coming in on the tailend relay, when the switch would at once be thrown to the interrupted condition and the signals would be recorded on the tape.

The arrangement of the locals from the relay points is one of the most interesting points of the service. The contact points of the relays may be transposed so that either the up or down stroke of the armature may be utilized to record signals. This, in connection with the arrangement to throw the relays one way or the other, constitutes the McCulloch principle of operation.

From the switchboard the local impulses are carried to the "timing" tables, which are also of metal and finished in golden oak like the switchboard frames. These tables are also made up in sectional form in a very substantial manner, and can be arranged to fit together either end to end or back to



Two Signal Routings.

ment on a running card in the same manner. Any alarm received over the system is transmitted to the Department.

The boxes are normally used to enforce a proper patrol of the premises during the night by the watchman employed for such duties, and unless he makes his rounds in the manner prescribed by the Underwriters, an investigation is made within fifteen minutes after the designated time and a written excuse secured, which is sent to the subscriber the following morning, and a copy, or transcript sent to the Underwriters' Bureau for their information. Under these conditions first class supervision of protected risks is maintained at all times.

While the new central station is at present only operating the burglar alarm and the night watchman fire alarm service, it is more than likely that sprinkler supervisory and valve alarm service will be inaugurated in the near future. This consists of devices attached to all gate valves, gravity tanks, pressure tanks and alarm valves in sprinklered risks, the object of which is to maintain at all times proper conditions for the working of sprinklers in the event of fire, and when a fire does take place, or a head is accidentally broken an alarm is received and transmitted to the Fire Department, bringing their assistance and saving heavy water loss.

The supervision of the water supply, air supply, etc., all being reported to the Underwriters each and every day, in addition to correction to be taken up with the engineer or other authorized person in charge of the equipment.

The automatic fire alarm is another branch of the service which in all probability will be taken up in the near future, the present office quarters being ample for all extensions, the board and tables being so arranged that extensions may be made to either end without any special inconvenience, or heavy expense except for the additional sections, instruments, etc.

The service and office was cut over to the new apparatus during May of this year at a cost of approximately \$3,500.00, the labor cost being heavy on account of much necessary Sunday and night work in trenching for conduits, etc. The plans for the office arrangement were laid out by J. M. Maddox, superintendent of the Pacific Division from San Francisco, assisted by Mr. C. M. Marron, general foreman, who also supervised the installation and cutover and is now acting as local manager in connection with his other duties. Mr. Chas. Kelley is in charge in the office during the day, Mr. Wm. Ingold having charge of the contract department, while Mr. H. J. Keppert assisted by Mr. P. St. Denis handle the installation and maintenance. The night force consists of night manager J. C. Kitchen, with two signal timers and three patrolmen.

Portland may be congratulated on the fact that there is not another central station signal office west of Minneapolis that can compare with it in the class of equipment, Minneapolis being the first office equipped with metal switchboards and other equipment of this type, while Portland follows as the second office so equipped.

LETTER TO THE EDITOR.

Municipal Ownership of Hydroelectric Power Plants.

Sir: The undersigned has, in the past, frequently discussed with you the question as to whether conditions in the United States in general, and on the Pacific Coast in particular, are such that municipal hydroelectric plants can be planned, financed and constructed with a fair certainty of ultimate success, and has expressed his opinion that the past history of the larger and more important municipal hydroelectric power plants has practically furnished the proof that no advantage is gained by the ultimate consumer if the public utility in question is operated by the municipality instead of being in the hands of a public service corporation.

Municipal ownership of public utilities has been customary in most of the European countries for a long time, and its evolution may be traced back to the beginning of the formation of communities, when a sufficient number of people had settled within one limited area, the community of interests resulting in the formation of the smallest size of a community—the village. The interests of all the village people were practically identical, and so were their requirements. Consequently economic considerations resulted in the establishment of certain conveniences by which every villager was benefitted, and which could be undertaken to better advantage by all the villagers jointly than if the same convenience had been provided by each inhabitant individually. Water supply was one of those conveniences which had first been taken up from a co-operative standpoint, whenever the loca-

tion of the village was such that the water had to be brought to it from a long distance. In other cases, the water had to be lifted from a lower level to a higher level.

In mediaeval times it was customary to place the villages on top of a mountain surrounding the castle of the knight under whose protection the farmers had flocked. The demand for water in those days was satisfied by the construction of a deep well, and one of the favorite actions in mediaeval warfare to prevent the rehabilitation of a village once destroyed was to either poison or destroy the well, thus making it impossible for the inhabitants to return.

Some of these mountain-top villages have lived through the ages, and are in their original location on some prominent mountain to the present day. The writer remembers to have seen in a valley of the Black Forest a pumping plant which was operated by a low-pressure turbine driving a high-pressure plunger pump in order to furnish water to the village several hundred feet higher on top of a hill out of the same creek that furnished the power for driving the turbine.

While water supply has formed a public utility operated by the municipality in practically all communities of an older civilization, in the western part of the United States the unique condition still exists that the water supply of cities of very large size is in the hands of corporations, and it seems that as long as the corporation furnishing the water supply was treated right by the citizens of the community, water of a good quality was furnished at a reasonable rate to satisfy all demands. Whether a municipality should control its water supply to the extent of owning and operating it, is practically no longer questioned. There is, however, great doubt whether a municipally operated water supply system will serve the people better, and will be operated as efficiently as a corporately owned water supply system.

Quite recently the water supply system of the City of Los Angeles has been extensively discussed in your columns and practically all sides have been heard with the exception of the side that is responsible for the work that has been done. Long before the City of Los Angeles engaged actively in the construction work for bringing water from the far-distant Owens River Valley to the city, voices were heard calling attention to the fact that this system of water supply meant going back to the times of the Romans, where the building of long aqueducts was a necessity because gravity conveyances in open conduits was the only means for bringing water into the houses of the inhabitants of a city that was not so fortunate as to be located on the banks of a river carrying potable water. In modern times long-distance aqueducts are really only justified if no nearer sources are available, or if the water brought into a city over a long distance is of so much better quality, or of so much larger quantity, that the huge expenditure for an aqueduct can be justly explained to the tax payers who will have to provide the interest and sinking fund for the bonds that will furnish the means to pay for the work.

Public ownership, however, has become a fashion; it has become a matter of sentiment; corporations have been accused of a multitude of sins by the press

and by individuals and by hungry politicians, and misrepresentations have been accumulated to such an extent that one can almost see the communal state as the only salvation of the people from the claws of the merciless capital.

The regulation of public utilities by public service commissions has been successfully tried in a number of States, and it seems that commissions and corporations can work in harmony for the benefit of the people. In California the extension of powers of the Railroad Commission is of so recent a date, however, that few of their rulings have been tested by court action. May be this is one of the reasons why the people apparently do not feel safe, as yet, from extortion by public service corporations, even under the newly instituted public service commission control, and guided by law makers, would-be law makers and office hunters, keep on clamoring for municipal control of such utilities which have, in the past, been considered as belonging in the realm of corporate ownership.

When it was found that long-distance aqueduct schemes could not be carried out at a reasonable cost a new war cry was raised; namely, that hydroelectric power would be generated as a by-product of the water supply, that the revenue to be obtained from this power would be such that the interest and sinking fund charges would be, to a material extent, borne by this revenue, and that water would be supplied to the people at a wonderfully low rate.

At the outset of this discussion it was stated that it was questionable whether municipal ownership could be considered advisable for hydroelectric power systems. In reading the discussion which appeared in your valued publication of October 24, 1914, under the heading, "Los Angeles Aqueduct Mistakes," and the letter to the editor published in your issue of November 7, 1914, one is almost forced to the conclusion that the time is not ripe for any municipality to own an hydroelectric power system and to compete with matured public service corporations which have had twenty years' experience in this line of business, and have filled the demands of the people in such a way that little is left to be desired, excepting some small details which may be improved upon, and which may be readily corrected under the present regime of the public service commission.

The Los Angeles aqueduct power bureau was instituted about four years ago as an off-shoot of the Los Angeles aqueduct bureau. Power plants were designed in that bureau under the direction of most able engineers permanently employed by the city, and under the supervision of a board of consulting engineers, composed of men who had gained prominence in the past in their particular field, and were well known for their personal ability. One would think that with such a staff wonderful results would have been accomplished, but the fact is that to-day the City of Los Angeles does not have the opportunity to provide money for interest and sinking fund for the aqueduct bonds out of the sales of power; it has not even completed the first power plant in the system; it has not arranged for any market nor distribution of that power and the present aspect is that it may be years before any power is generated in connection with the Los Angeles aqueduct; not for engineering reasons

alone, but for other reasons which are bound to appear wherever a municipality takes it upon itself to defy the powerful interests of the once established public service corporation.

In this line of endeavor the City of San Francisco has, for more than a decade, tried to outdo Los Angeles, or at least to do equally as well, and after many years of persistent efforts, about a year ago the Secretary of the Interior gave the City of San Francisco a grant empowering it to use the water of the Tuolumne River stored in the Hetch-Hetchy Valley for a water supply to the city, conditional, however, upon proceeding immediately with the development of the large amount of power which can be obtained as a by-product along the line of the projected aqueduct.

No longer is the promise made by municipal officials, to bring Hetch-Hetchy water to San Francisco within three years. On the contrary, it is admitted that the far-distant source will not be called upon until all resources of the Spring Valley Water Company's properties are developed, conceded to be sufficient for 750,000 people. The power must be developed immediately, though, lest the grant of Hetch-Hetchy be lost.

The experience of the City of Los Angeles should be a valuable lesson to the citizens of San Francisco, and when it comes to providing the funds for successfully carrying out the Secretary's condition upon which the permit was granted, every precaution should be taken to see that the power plants will not only be designed and part of the equipment purchased, but that the entire power system will be carried to ultimate success for the benefit of the citizens who will have to pay for it, and before determining anything else the question should be answered—where is the market for municipally operated power plants within the limits of the City and County of San Francisco?

Yours truly,

HCH. HOMBERGER,

San Francisco, Dec. 4, 1914.

TROLLEY BUSES AT SHANGHAI.

Seven trolley omnibuses have been purchased in England for use in connection with the electric street car service in the International Settlement at Shanghai. Four of the busses have already arrived, but the remainder are detained on account of the European war. In the meantime it will not be practicable to use the busses already received because of the inability to arrange a satisfactory schedule.

Thus far it has been possible to introduce the American electric storage battery busses in China, and it is believed by street car managers in the Orient that the trolley busses may be operated on many of the narrow streets with profitable results. It is estimated that the cost of the trolley wire construction would not exceed the outlay required in purchasing storage battery trucks. It is assumed that the battery bus is more popular in the United States because of the objection of the municipal authorities to the trolley wire installation in residence districts where no street car tracks are built. Moreover, on wide and congested streets it is assumed that trolley omnibuses would not be suitable because of required right of way and overhead trolley construction.

INDUSTRIAL USES OF FUEL OIL

BY F. B. DUNN.

(Continued.)

Strainers.

All fuel oils carry a certain amount of foreign matter in suspension. Some of the impurities settle out while the oil is in the storage tank; but if the oil is heavy and viscous, much of the foreign matter will remain in suspension and be pumped to the burners

illustrated below, to indicate the various ingenious devices that have been contrived.

Fig. 36 illustrates a simple basket type of oil strainer. This type is cleaned by removing the plug at the top, taking out the basket, and rinsing it with kerosene. Fig. 37 illustrates the method of connect-

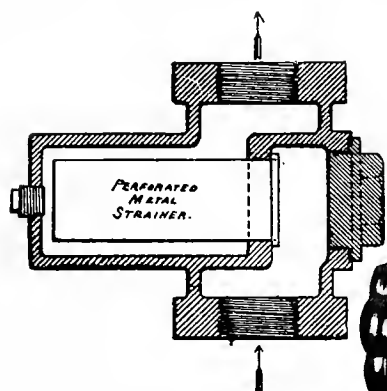


Fig. 36. A Simple Basket Type of Oil Strainer.

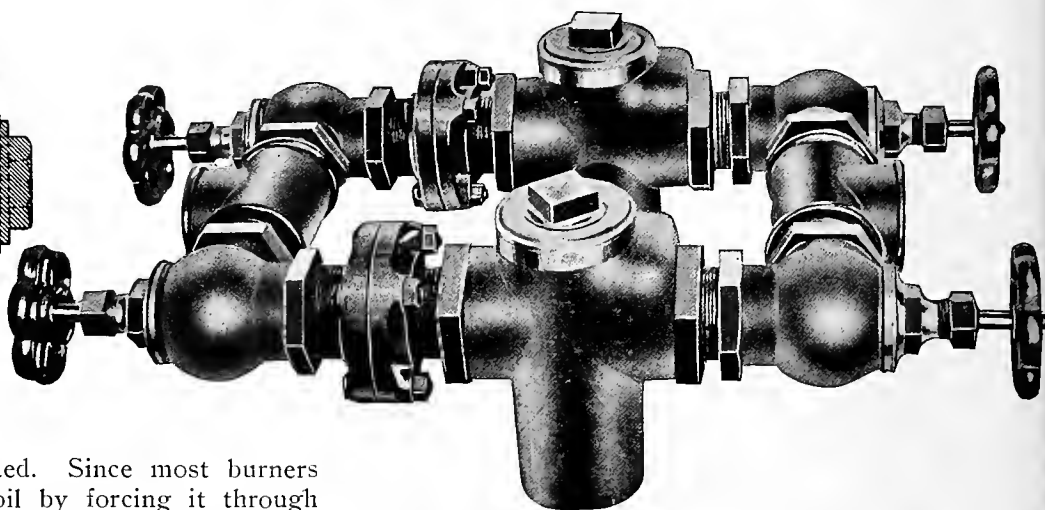


Fig. 37. Method of Connecting Basket Strainers.

unless a strainer is provided. Since most burners break up or atomize the oil by forcing it through small orifices, it is essential that there be an efficient strainer in the oil feed line, to remove all traces of gritty matter before the oil reaches the burner.

A good oil strainer must separate all solid matter suspended in the oil, and be large enough to retain the

ing a set of basket strainers. It is necessary to connect them in duplicate as shown, to permit continuous operation of pumps and burners while one strainer is being cleaned.

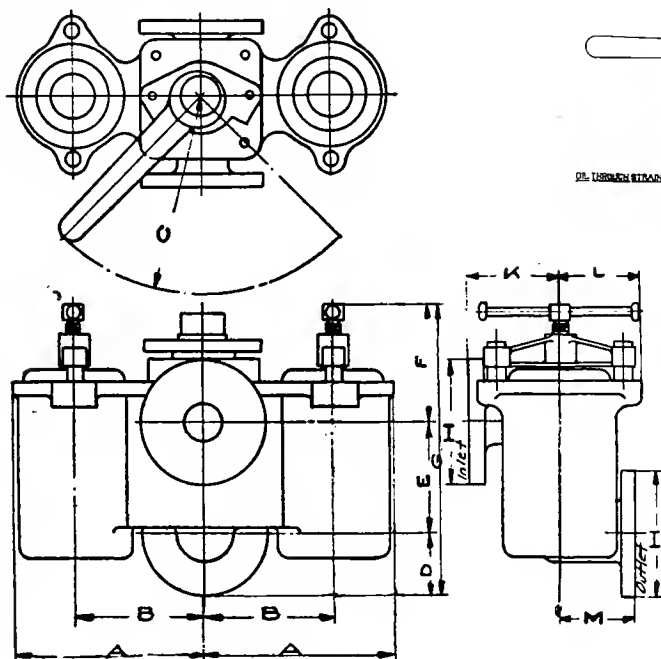


Fig. 38. Duplex Type of Strainer.

material removed for a considerable time, unless it is of a self-cleaning type.

Strainers are made in various sizes and shapes, a wire netting or perforated metal of some sort being used to separate the dirt from the oil. A few are

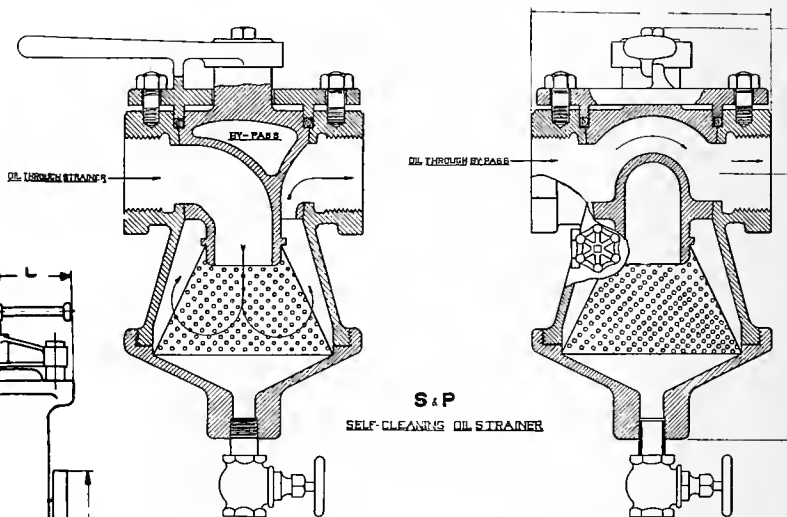


Fig. 39. Strainer for Suction Line of Pump.

Fig. 38 shows a set of duplex oil strainers and plug cocks. Either strainer can be used while the other is being cleaned, without affecting the oil pressure. Fig. 39 illustrates a compact self cleaning oil strainer. The oil passes to the center, down the central tube and is strained by passing through the perforated cone. The clean oil passes up to the exit, while the dirt settles at the bottom of the strainer. By opening the bypass valve, oil flows directly through the line. Then by opening the valve at the bottom of the strainer

the dirt can be forced out with steam, which is supplied by opening the small valve at the side of the strainer.

This type of strainer has many advantages. It can be operated and cleaned without soiling the hands, and is thus a time-saver. The flow or pressure of the oil is not changed while cleaning. And if a leak in the suction line causes difficulty in the operation of the pump, it can be readily located by closing the suction valve at the pump and opening the steam valve on the strainer. In this manner steam is forced into the suction line and the leak will be indicated by the issuing steam. Heavy oil can also be heated in this manner when there is difficulty in starting the oil pump on a cold morning.

[To be continued.]

MUNICIPAL POWER PLANT AT BANGKOK, SIAM.

The recently completed power station for the city of Bangkok is built entirely of brick and reinforced concrete and measures 121 by 135 ft. Owing to the abundance and cheapness of paddy husk as compared with coal and wood, this by-product of rice milling is used as fuel for power houses in Bangkok wherever possible. In order to insure a minimum of manual labor in conveying the bulky paddy husk to the furnace, a system of conveyors was installed as a part of the plant, the principle being an electrically driven Archimedian screw revolving in a steel casing. An 80 ft. teak wharf was built to receive the paddy husk from the boats and to receive the lower end of the first conveyer, while the upper end is anchored to the end wall of the husk house.

The method adopted in feeding the boiler furnaces from the bunkers consists of a simple arrangement of mechanically controlled shutters, whereby the husk may be readily regulated as the demands for steam arise. The husk store is a building 164 by 66 ft., constructed of concrete pillars and brick walls between. The capacity of this store is equivalent to one month's requirements of paddy husk, while the bunkers hold a quantity sufficient for two weeks' demands at full load.

Babcock & Wilcox boilers have been installed in four batteries. While paddy husk is the primary fuel, liquid fuel, coal, or firewood can also be used. Liquid fuel will also be stored overhead, but only for use in the event of paddy husk giving out. Superheated steam will be used entirely for the steam turbines, the boiler pressure being 200 lb. to the square inch. The heating surface of each battery of boilers is 6480 sq. ft., while the heating surface of the superheater is 1980 sq. ft. One boiler will always be kept for liquid fuel. The chimney in connection with the boilers is of steel, and one of the highest in Bangkok, being 162 ft. from ground level and 8 ft. in diameter.

This station provides current for lighting a large area occupied by royal palaces and residences for Siamese nobles. The motive power for operating the machinery of the Bangkok waterworks and the opium factory is also supplied by this plant.

FIGURING PROFITS FOR THE CONTRACTOR.

BY A. H. HALLORAN

A new science of management has recently come to the aid of the profitless business. Its principles can be applied to any organization whose prime purpose is profit, and particularly to electrical contracting, which is notoriously a profitless business.

The first essential of an efficient organization is a capable manager, who has a few practical ideals which he can teach to his organization. Business success today depends upon a man's power of getting work out of his people, which in turn depends upon his power of supplying them with ideals. Managers must be teachers. Their chief duty is to teach other people how to do things.

By precept and example the manager should first set the ideal that continuous profit is the most important object of the organization. Profit is dependent upon four factors—confidence, service, fair competition and effective co-operation. Business must first have the confidence of its patrons before it will be given a chance to serve them. Modern success is based upon the science of being believed in—confidence. Satisfactory service is the source of profit, and may most clearly be defined as anticipating the need of the patrons.

The manager must be able to inspire confidence, enthusiasm and loyalty in order to maintain discipline and get results. Discipline is the first step in effective co-operation—the real measure of the difference between individual effort and team work. The ability to inspire confidence is based primarily upon strict honesty—of purpose, as well as of word. Kindliness follows; it expresses closeness to the human kind, for none of us believes in him who does not believe in us. Enthusiasm inspires confidence, and can be communicated to others by directing their thought and feeling towards some element in the work which is interesting, such as the spirit of the game, or the desire to surpass previous records. When playing the game, we enjoy our work. Loyalty is not one-sided. It is as necessary for the firm to be loyal to the employe as for the employe to be loyal to the firm.

While these qualities seem platitudinous and altruistic they are usually the underlying cause for the success of any organization.

Assuming such an organization, its first requirement is accurate records. The electrical contracting business, more than any other perhaps, requires dependable records as the base for estimates. They reduce estimating to a science instead of a guess. Many a contractor has been forced to the wall because he made "guesstimates" instead of estimates.

Records are also necessary in setting standards. Standards of design, product and delivery are the greatest supports which any contractor can have. The underwriter's code is a standard based upon records, and specifies standards for material. You should likewise have standards relating to the amount of work to be done by each of your employes, and you should standardize all instructions, conditions and operations.

Good judgment, the asset of an executive which represents half his worth, should be largely a matter

of scientific analysis of records. Whether this be exercised in hiring and firing employes (frequent discharges are the tell-tale of incompetent management) or in deciding policies, judgment is strengthened by adequate records.

The essence of these remarks is to plan your work by means of records and standards and then work your plan, getting action by despatch. This means that the manager first decides what work is to be done, determines when it shall be done, advises how it shall be done, and assigns who shall do it. The answer to these four questions gives the plan, and it is then up to him to see that the work is done on schedule time.

After the organization has been thus clearly defined, it becomes necessary to determine a method for the handling of orders which will ensure their immediate despatch, efficient execution and correct cost distribution. If an efficiency engineer were handling this problem, he would draw a diagram to determine the order of the routine, so that all operations would be done by direct action without waste of time or material. He would arrange that the material be ready simultaneously with the labor, so that there would be no waste of either.

Failure to plan work is one of the greatest causes of inefficiency in the contracting business. Lack of despatching facilities has created more waste of material and time, and made more disgruntled customers than any other one element in the business. All work should be analyzed and reduced to individual, minute operations. These operations are assigned to the departments where the work is to be done, and they are responsible for its being done on time.

The contracting business may be sub-divided into the following heads:

First—Finance; for it is as difficult to get into business without money as it is into society without clothes.

Second—Administration, which involves competent counsel, good judgment and common sense.

Third—Selling, which we have already shown to be dependent upon confidence and service.

Fourth—Purchasing.

Fifth—Housing materials and supplies, which represent cash, and should consequently be carefully protected.

Sixth—Collections, including credits.

The fundamental principles of planning and despatching are applicable to each of these divisions.

Any organization developed for the purpose of profit must recognize the fundamental requirement of knowing correct costs and therefrom the correct determination of profit or loss. When the average contractor is asked the question—"Who cut the price?" he is inclined to shrug his shoulders, and blame the man whose bid is lower than his own. As a matter of fact, he seldom knows—and so continues to play the great American game of passing the buck instead of digging in and finding out "who cut the price" below cost. Either his costs are too high, or his competitor is taking business at a loss. It is this ignorance of cost, not wilfulness, which makes electrical contracting such a poor business, not only for the contractor, but also for those who sell to the contractor.

As accurate systems for finding costs have been worked out by experts, it is here proposed to merely emphasize the importance of cost finding, and pass on to a more frequent cause of failure in the contracting business—ignorance as to how to figure profits when costs are known.

In the commercial world profit is the final test and measure of success. It is the excess of receipts over expenditures, the difference between what it costs to produce and market an article and what that article sells for, the selling price being made up of the cost of labor and material, the overhead expense and the profit. But knowing what constitutes profit and figuring profit correctly are two entirely different propositions, for profit is figured as a ratio or a percentage, and is consequently comparative, depending upon whether the profit is figured with reference to the cost or with reference to the selling price.

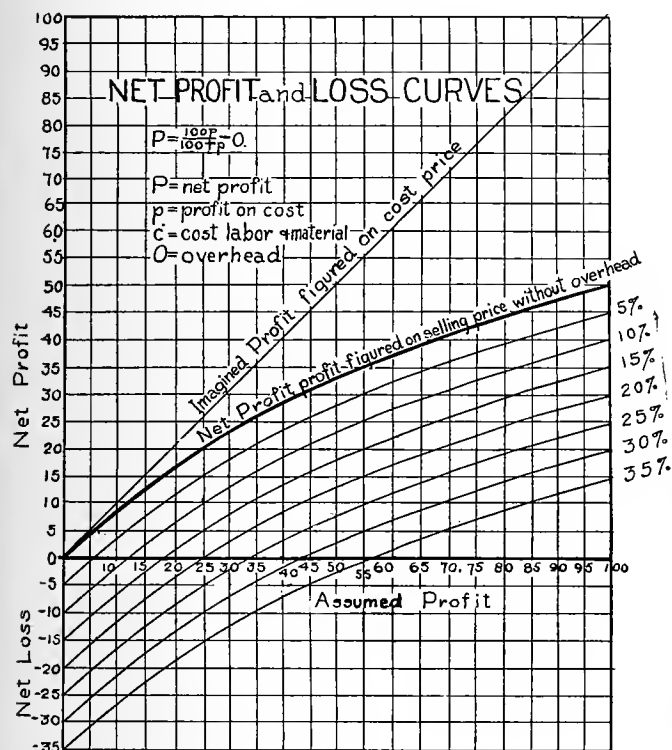
When most of us went to school we learned that the percentage of profit is figured on the basis of the cost price. This method is still used in many elementary text books on arithmetic, and so deeply has this idea become embedded in our minds that the natural impulse of most of us is to determine our selling price by merely adding the assumed per cent of profit to our cost price. When a socket costs 15 cents, and sells for 25 cents, we figure that we have made 10 cents on an investment of 15 cents, or $66 \frac{2}{3}$ per cent (neglecting the overhead for the time being). Really, we have made 10 cents on 25 cents, or 40 per cent profit.

Dividends are always figured on the basis of gross sales; but dividends are nothing but percentages of profit, and these likewise should be figured on gross sales. Sales, not costs, are what we are working for. The 100 per cent represented by sales is made up of, say, 20 per cent overhead, 10 per cent profit and 70 per cent cost. Consequently, you should assume your per cent profit first, add to it the per cent overhead, or cost of doing business, and subtract their sum from 100 per cent to find the per cent cost. Knowing the cost, it is then simply a problem in proportion to find the correct selling price.

It is really surprising what a big difference there is in the two methods of figuring. While tables have often been published to show this, the accompanying diagram presents it more graphically. They are called "net profit and loss curves," net profit being shown above the heavy horizontal line, and net loss below. The intersections of the diagonal line, show the imaginary, or assumed profits when figured on a basis of cost. The upper curve shows the corresponding net profit when figured on the basis of the selling price, neglecting the overhead. For example—follow the vertical line marked "25 per cent" until it intersects the curve at the horizontal line, marked "20." This means that 25 per cent assumed profit on the cost price is only 20 per cent net profit on the selling price. Similarly, the 50 per cent vertical line intersects the $33 \frac{1}{3}$ per cent horizontal line, and the 100 per cent vertical line intersects the 0 per cent horizontal line.

The point that the curve emphasizes is the danger of fooling yourself into the idea that you are making a fair profit, whereas you may really not be making a living expense. There is no harm in figuring profit on

the basis of cost, if you fully realize what you are doing—that in figuring 66 2/3 per cent on cost you are only making 40 per cent on the selling price. But to blindly imagine that you are making sufficient profit when you are really losing money, is poor business, to say the least.



Profit and Loss Curves.

These curves also give an approximate idea of what net profit corresponds to each imaginary profit. Thus, if you want to make a net profit of 25 per cent, follow the horizontal line from the left from 25 until it intersects the net profit curve, and dropping a vertical line upon the heavy black horizontal line, you will see that it cuts it at 33 1/3 per cent. If the exact amount is wanted, you can easily find it from the

formula $\frac{100p}{100+p}$ which means, to multiply the as-

sumed profit figured on a basis of cost, by 100, and divide the product by 100 plus the assumed profit, thus finding the net profit, if the overhead is neglected.

The other curves on the diagram show the effects of overhead, which is deducted from the net profit. You will notice that most of them drop below the heavy horizontal line at some point, and this means that business is then being conducted at a loss.

For example, if you are in the habit of determining your selling price by adding 25 per cent assumed profit to the cost of labor and material and deducting 25 per cent for overhead, you are really losing 5 per cent, as shown by the intersections of the horizontal line with the 25 per cent curve. Or if you assume 55 per cent profit, and deduct 35 per cent for overhead, you are just breaking even, there being no profit. Accurate calculations of the net profit, in any case, is given by the formula shown on the diagram.

Examples.

1. If labor and material on a job cost \$1000, the overhead is 25%, what would be the profit or loss if an assumed profit of 25% is added? Answer—5% loss.

2. In the same job, what assumed profit must be added when it is desired to make a net profit of 20%? Answer—32%.

Proof:

Cost	\$1000	Net profit = 1/5 \$1820..	\$ 364
Assumed profit.....	820	Overhead = 1/4 \$1820...	455
		Cost	1000
Selling price.....	\$1820		
			\$1819

The foregoing only skims the surface of efficient management in the electrical contracting business. Time will not permit further elaboration. Much more might be written, particularly on the matter of labor, and rewards for service, but if these few remarks set you thinking, and emphasize the correct method of figuring profits, the attempt is justified.

PRICE MAINTENANCE.

BY R. F. BEHAN.

The manufacturer of an article (which is unpatented) upon which he has placed his trademark and which he has advertised extensively, cannot control the resale price by contract, agreement or any other understanding after the title to the article has passed from his possession. Dealers can sell his article at any price they please, as he has no recourse. If he refuses to sell them articles on the ground that they are price cutters, making this specific reason the basis for not selling, the manufacturer violates the Sherman Act.

The United States Supreme Court Decisions in the Sanatogen case and the Indiana case, have caused great dissatisfaction among the manufacturers and wholesalers throughout the United States, and the subject was widely discussed in the periodical literature, as follows: Everybody's Magazine, May, 1914, April, 1913; Overland Monthly, August, 1914; Collier's Magazine, July 4, 1914; System Magazine, August, 1914; The Outlook, September 20, 1913, May 24, 1913, February 7, 1914; Current Opinion, January, 1914; World's Work, January, 1914; Harper's Magazine, November 15, 1913, June 14, 1913.

There is a good series of articles in the Scientific American, commencing June 7, 1913, June 14, 1913, June 21, 1913, July 5, 1913, July 12, 1913, July 19, 1913, August 2, 1913, August 9, 1913, and August 16, 1913.

The whole matter is briefly summed up in the April 20, 1914, issue of the Independent Magazine. At the present time, there is up in the House of Representatives, Washington, the Stevens Price Maintenance Bill, H. R. No. 13305, and the matter is being studied by the United States Bureau of Corporations.

It is apparent that the new Interstate Trade Commission recently appointed by President Wilson will take this matter up actively, and finally decide whether the business of this country will be done on the basis of a standard article for a standard price or if we are to become a nation of hagglers, charging whatever the traffic will bear.

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Many well-meaning people believe that the desire of manufacturers to fix the retail price of their product is in some way concerned with strengthening monopoly. A mistaken idea is prevalent that monopoly can be destroyed by forbidding the maker to name the price at which his goods are to be sold. As a matter of fact, the reverse is true, as a brief consideration will show.

Price

Maintenance

A manufacturer of electric heating devices, for example, as an important part of his selling campaign, advertises their merits to the buying public extensively and intensively. He identifies his product with his name or trademark. On the fair basis of one price to all he gives wide publicity to the retail price of the article. He follows up this creative sales work by getting the various dealers to stock his appliances and he lends his aid in helping them move the stock at the advertised price, which is fixed so as to give the dealer a fair profit.

As a consequence, every purchaser knows that he is paying the same price as every other purchaser. He buys his goods with confidence. He does not try to beat down the price or to haggle in Chinese fashion.

Meanwhile some short-sighted dealer imagines that by cutting the price and selling the advertised article at little or no profit he can lure customers into buying other goods sold at more than their worth, so as to make up the loss on his "leader." Or a central station may conclude to load its circuits with current-consuming devices sold at cut rates, thereby losing the co-operative sales effort of every electrical dealer in its territory. In either case the result is equally disastrous, not only to the manufacturer and legitimate dealers, but also to the central station and the ultimate consumer. Such unscrupulous tactics, if unchecked, kill the market for the standard device and increase the sales of inferior articles at higher prices.

The evils of price cutting are real, those of price fixing are imaginary. The trouble comes not from fixing a price, but from fixing an exorbitant price. This soon corrects itself. For if the price is too high, either the public will not buy or a new article will be manufactured to compete with it.

Prevention of unfair competition has been the underlying motive in governmental regulation of business. Where competition is the subject of attack, unfairness is the object. Unfairness thrives upon secrecy, it lives in the dark, but is destroyed by the bright light of publicity. Truthful publicity is the keystone in the arch of the new competition, whose foundations are quality, justice, fair dealing, and the confidence of a discriminating public.

The Stevens Bill, which has been pending in Congress of some months, is intended to remedy the condition which makes it a crime for a manufacturer to say at what price his product shall be sold. It proposes that the manufacturer be allowed to insist upon the maintenance of the advertised price without the necessity of resorting to the subterfuge of selling only to authorized agents. The bill provides for wide pub-

licity as to price and a strict maintenance thereof. Its speedy enactment is an immediate necessity for continued economic growth.

The national engineering associations are commencing to realize the vital need for greater coherence among individual members. Some years ago the American Institute of Electrical Engineers awoke to the fact that individual interest in far-away centers was largely dependent upon local activity. Sections were established in each of the important cities of the country, interest was intensified, and membership increased so rapidly that the American Institute of Electrical Engineers, though the youngest, is now the largest engineering organization in America. The other engineering societies are now following this precedent and flourishing sections of mechanical, civil and mining engineers are now active in several of the Pacific Coast cities. The electrical engineers, however, are still in the lead on the Pacific Coast with successful sections at Vancouver, Seattle, Spokane, Portland and Los Angeles.

A further localization of effort now seems necessary to more closely tie in the interest of the several local sections. The suggestion has been made to the American Institute of Electrical Engineers that this result can be accomplished by means of territorial vice-presidents. Four of the six vice-presidents now in office live in New York or within a few hours of that center. While this may be a great convenience in attending meetings, it does not give adequate nor intelligent representation to the other parts of the country. Furthermore there are sixteen other members of the board of directors from whom to draw the quorum of five necessary for transacting most of the routine business of the Institute.

This suggestion for a territorial vice-president originated at the annual convention in 1913 where John B. Fisk, the father of the Spokane section, was its most active sponsor. The idea was favored by Dr. C. P. Steinmetz and other influential members and was referred to the board of directors. No definite action has since been taken. The plan was discussed at the Pacific Coast meeting in Spokane this year and many good reasons advanced for its adoption.

It was proposed that a territorial vice-president should visit the several sections in his district once or twice a year and secure their views on such matters of policy as conservation, patent laws and relations with other bodies. He could be of great assistance in bringing about a closer co-operation between the several sections, could intelligently form new sections, and strengthen the existing ones, and could represent the president in his absence. The expenses in connection with this work would of course be borne by the parent body.

The advantages in perfecting a more closely knit organization are so manifest and the changes in the constitution and by-laws are so slight, that the only remaining problem is one of determining the territorial limitations of each district. Several methods have been suggested, including a numerical division, a division according to area, and one according to the

number of sections in a district. These details could be soon settled by mutual agreement.

Concerted action has already made possible a close approximation to this ideal, except that the duties of the vice-presidents have not been extended to make them the true representatives of their several districts. Two years ago the Western sections, for instance, agreed upon Mr. J. A. Lighthipe of Los Angeles as their choice and on their recommendation he was elected. Similar action is expected with regard to Prof. H. J. Ryan of Stanford University at the next election after he had definitely refused to be a candidate for the office of president.

If the individual members in all sections of the country will indorse this plan for giving them better representation in the Institute councils, there will be little difficulty in putting the idea into early execution. The idea is in accord with the fundamental economic principle that most powers can be most efficiently exercised by delegating it to some agent directly responsible to those who would be benefitted by having it enforced. In this case both parties would be benefitted.

Christmas is essentially a festival of light, not only symbolically, but also literally. Coming at the darkest season of the year, the cheery brightness of the incandescents is doubly welcome. Nor is there any branch of illumination where electricity has contributed more to safety than in the lighting of the tree and the home at this joyful period. Many new and beautiful designs are available for this purpose.

Every year the electrical Christmas is becoming more and more a reality. Already the lighting peak on Christmas day is fast approaching the regular load curve, which flattens out on this day of rest and good cheer. Neither is this electric load entirely due to lighting, for the giving of electrical gifts is becoming an annual custom.

This custom has been stimulated by beautiful window displays in all the electrical stores throughout the country. Electrical devices lend themselves particularly well for this purpose and make a great attraction, especially if there is "something that moves" in the display. The various colored lights, the bright polished surfaces and the unique designs combine in attracting the attention and suggesting electric gifts as suitable presents. These displays have recently been supplemented by well-prepared booklets, illustrating the varied applications of electricity in the home.

Of electric appliances suitable as gifts there is endless variety. Electricity symbolizes and materializes heat, light and power; it is emblematic of comfort, and idealizes service. From babbling babyhood to declining dotage there is some electrical device which will increase the happiness of every member of the family.

Hence we take a peculiar pleasure, not merely in wishing but actually assuring our readers a "Merry Christmas." On this day let care be forgotten and peace reign supreme. Electricity is so closely identified with the spirit of Christmas that all its devotees should rejoice.

District Representation

An Electrical Christmas

PERSONALS

H. H. Cudmore, director of the Mazda Bureau of the General Electric Company, is at Los Angeles.

F. E. Wieser, an electrical contractor of Paso Robles, Cal., was a visitor to San Francisco during the week.

G. L. Oman, auditor for the Portland branch of the General Electric Company, was in Seattle on business recently.

A. L. Bradley, in charge of the electrical equipment Hammond Lumber Company, Eureka, spent the week in San Francisco.

F. H. Leggett, manager Western Electric Company, San Francisco, has returned after a week's trip through southern California.

E. A. Quinn, general superintendent San Joaquin Light & Power Corporation, Fresno, was a visitor to San Francisco during the week.

O. L. Coward, representative of the General Electric Company at Juneau, Alaska, has returned to Seattle where he will remain until spring.

T. E. Bibbins, local manager of the General Electric Company, at San Francisco, has returned to his office after recovering from a protracted illness.

A. E. Wishon, assistant general manager San Joaquin Light & Power Company, of Fresno, has been confined to his bed the past week at San Francisco.

John J. Portley, recently of San Diego, Cal., has been employed in the commercial department of the Utah Light & Traction Company at Ogden, Utah.

W. R. Pounder, representative of Hubbard & Company, San Francisco, left the latter part of the week for a trip through the Sacramento Valley, California.

L. A. Somers, manager industrial and power division of the Westinghouse Electric & Manufacturing Company, is at the St. Helena Sanitarium at St. Helena.

A. J. Myers, Pacific manager Wagner Electric Manufacturing Company, recently returned from a business trip throughout the southern part of California.

B. A. Hansen, representative of the A. G. Electric Company, San Francisco, left the latter part of the week for a several days' trip through southern California.

J. I. Colwell, manager Western Electric Company, Seattle, was a visitor in San Francisco during the week enroute to the coming Jobbers' Convention at Del Monte.

Charles V. Aspinwall, city salesman for the Seattle branch of the Westinghouse Electric & Manufacturing Company, is being congratulated upon the arrival of a son at his home.

Clark Baker, field representative of the Mazda bureau of the General Electric Company, expects to leave for Cleveland about the nineteenth of this month, where he will spend the holidays.

Frederick D. Nims, formerly electrical engineer with the Western Canada Power Company, Limited, Vancouver, B. C., has joined the staff of the Olympic Power Company at Port Angeles, Wash.

P. B. Hyde, representative primary battery department, Thos. A. Edison Company, San Francisco, returned during the week after an extended trip through the important cities of the Pacific Northwest.

T. Finnigan, vice-president of Pierson, Roeding & Company, San Francisco, who has been making a trip through the East and who expected to return at an early date, has been temporarily detained owing to the death of his father at Arlington, N. J.

C. V. Schneider, electrical contractor, Sacramento; **F. Somers**, electrical contractor, San Jose, and **Mr. Gelpin**, of Oakland, were in San Francisco during the week in at-

tendance at the executive committee meeting of the California State Electrical Contractors' Association.

P. M. Bone has succeeded **B. L. Carson** as member of the Centralia office of the Pacific Telephone & Telegraph Company, Mr. Carson having been transferred to the company's office at The Dalles, Oregon. Mr. Bone was formerly connected with the Seattle office of the company.

Elmer A. Clark, head of the claims department of the Boise Traction Company, has accepted an offer to occupy a similar position with the Utah Power Company, where he will have charge of all claim adjustments, rights of way, etc. His headquarters will be in Salt Lake in the future. Mr. Clark will leave Boise this week but his family will not leave until holiday time.

Newcomb Carlton, president of the Western Union Telegraph Company, was a visitor in Los Angeles last week, being on a tour of inspection, in order to get more closely in touch with Pacific Coast conditions. The other members of the party were as follows: **J. C. Willever**, commercial general manager; **L. McKisick**, assistant to the president; **W. N. Fashbaugh**, general traffic superintendent; **G. M. Yorke**, general plant superintendent; **W. C. Merly**, secretary of the party. All these are from New York. They were accompanied to Los Angeles by the following Pacific Coast officials from San Francisco: **C. H. Gaunt**, general manager; **H. F. Dodge**, assistant general manager; **C. A. Rhodes**, auditor; **H. C. Chace**, traffic superintendent; **J. L. Ord**, plant superintendent.

MEETING NOTICES.

Pacific Coast Electrical Supply Jobbers' Association.

The next meeting of the Electrical Supply Jobbers' Association will be held at Del Monte, December 16-18. There will be an open meeting with the Manufacturers and Jobbers on Friday, the 19th. The regular golf tournament will take place on dates to be announced. The committee is now arranging to make the golf dinner, a dinner dansant.

Alameda County Electrical Development League.

At the last meeting of the Alameda County Electrical Development League the following officers were elected for the new year: President, **Ben C. Hill**; First Vice-President, **Romaine B. Myers**; Second Vice-President, **F. A. Pinger**; Secretary-Treasurer, **Alfred Nylen**.

Following the regular order of business **R. L. Holabird** gave a short talk on "The Ethics of Business." The spirit of co-operation that exists in the League is shown in the variety of branches of the industry represented by the new officers. Mr. Hill is the head of the Electrical Department of the City of Oakland; Mr. Myers is a consulting electrical engineer; Mr. Pinger is a contractor in Richmond; and Mr. Nylen represents a jobbing house, the Gilson Electric Company.

Oregon Society of Engineers.

The regular Monday luncheon held November 30th, at the Benson Hotel was addressed by **Mr. R. W. Raymond**, secretary of the Manufacturers' Association, on the "Engineer's Part in the Home Industry Movement." Mr. Orrin Stanley, secretary of the I. E. L., being chairman of the day. Mr. Raymond pointed out the difficulties the Oregon Manufacturer had to contend with, including freight rates, which would not allow him to compete in Eastern markets and at the same time allowed the Eastern manufacturers to ship all "over" stock here and cut prices to "move" their stock. Also the eight hour law in Oregon caused a hardship, as other states were not uniform on this subject. Last and not least was the lack of public support by the people in trying to use Oregon products instead of products manufactured outside of Oregon. The only salvation he could see was the development of cheap hydroelectric power and the fact that Oregon labor was more efficient than Eastern labor. He claimed that the Oregon labor was estimated at 17 per cent more efficient than Eastern labor.

Joint Meeting of the Local Sections of the A. I. E. E. and the N. E. L. A., Portland, Oregon.

The regular meeting of the Joint Sections of above associations was held the evening of December 1st in the auditorium of the Journal Building, Mr. R. F. Monges presiding. Mr. J. C. Stevens, civil and hydraulic engineer, of Portland, Oregon, gave an informal talk on his experiences in Spain, when connected with the Pearson Engineering Corporation of New York City, who were developing a large project in the province of Cataluma. All this development work is now halted on account of the European war. Mr. Stevens illustrated his talk with several pictures thrown on the screen by a reflectograph. Mr. Stephens dwelt upon the general aspect of engineering in Spain and the opportunities and limitations of power development there. In the course of these remarks he said: The feeling in Spain is not antagonistic to Americans. The common people in nearly every case do not know there ever was a war with the United States. Their only public interest is in the public bull fight and the national lottery.

The Jovian Electrical League of Southern California.

A large number of Jovians and several prominent out-of-town guests attended the weekly luncheon at Christopher's on Wednesday, December 2, presided over by W. L. Boxall, who had arranged an extremely interesting and unique program. Tribune Pieper appointed R. G. Berle and F. B. Nightingale as the reception committee for January. He announced that the next rejuvenation would be held on January 7th, and that fifteen candidates had already been secured. The three-minute talks were given in a happy vein by K. E. Van Kuran on Jim Colkitt, and E. R. Northmore on R. H. Manahan. The chairman then introduced George B. Muldaur, manager of field co-operation of the Society of Electrical Development, who explained the aims and accomplishments of the society. He paid high tribute to Los Angeles Jovians by referring to this meeting as the best "turn-out" he had witnessed anywhere in the United States. He emphasized the fact that he had come West to learn of Western needs and conditions, as the society did not intend to force Eastern requirements on Western communities. He pointed out the opportunity for the development of the electric vehicle industry in the West and invited those who are not members at present to become affiliated with the society.

San Francisco Section California State Contractors' Association.

At the meeting of the San Francisco section held Saturday, December 5th, the following executive officers were re-elected for the ensuing term: President, C. F. Butte; Vice-President, N. M. Hope; Secretary-Treasurer, W. H. Hanbridge; Sergeant-at-Arms, Geo. Smith.

The following committees have been appointed by the California State Contractors' Association to serve in connection with the 1915 National Electrical Contractors' Convention to be held in San Francisco the coming year.

General Chairman, W. H. Hanbridge; Finance, C. F. Butte; Reception and Dance, W. Kohlway; Dinner on Boat Ride, Geo. Sittman; Dinner Dansant, W. Kirsten; Auto Rides for Visitors, L. R. Boynton; Open Meeting, N. M. Hope; Reception Committee, H. C. Reed; Ladies' Reception Committee, Mrs. L. R. Boynton; Zone Committee, Pop Hughes; Exposition Committee, C. L. Chamberlain; Boat Ride, M. Fortini; Music, Geo. Smith.

Electrical contractors and dealers of California held a co-operative dinner Wednesday night at the Hof Brau. The party sat down at 6 p. m. and a most enjoyable evening was spent. Speeches and a general discussion of the principal subject affecting the electrical retail and contracting business were indulged in.

Los Angeles Members of the Society for Electrical Development.

In order to form a local organization for the purpose of effectively carrying out the aims of the Society for Electrical Development in Southern California, the members in Los Angeles met George B. Muldaur, field representative of the society, at a luncheon at the Jonathan Club, on Friday, December 4th. Those present were: George B. Muldaur, J. G. Pomeroy, manufacturers' agent; K. E. Van Kuran, Westinghouse Company; J. O. Case, General Electric Company; T. E. Burger, Western Electric Company; H. B. Woodill, Woodill-Hulse Electric Company; C. H. Carter, Pacific States Electric Company; Carl C. Young, Illinois Electric Company; C. W. Baker, Electric Lighting Supplies Company; N. W. Graham, Holabird-Reynolds Electric Company; C. E. Johnson, U. S. Electric & Manufacturing Company; Thomas Foulkes, Foulkes Electric Contracting Company, and Max Loewenthal, consulting engineer, as guest. Mr. Muldaur presented the aims of the society and then a general discussion of local conditions followed, which resulted in the appointment of the following committees by Permanent Chairman J. G. Pomeroy, who selected Carl Young as secretary: Committee to meet with representatives of the lighting companies in regard to the sale of appliances, C. H. Carter, K. E. Van Kuran, C. W. Baker; committee to make endeavor to have lighting companies become members of the society, Geo. B. Muldaur, N. W. Graham, J. O. Case; committee to consider the advisability of an electrical page, C. H. Carter, Carl C. Young, H. B. Woodill. J. O. Case was appointed delegate to the meetings of the Electric Vehicle Association.

Oregon Hydroelectric Conference.

The hydroelectric section of the commonwealth conference will meet Saturday, December 12th, at the State University. The earlier days of the conference, December 10th and 11th, are to be devoted to "Unemployment" and "Reorganization of the State Administration."

Hon. John McCourt, ex-United States District Attorney for Oregon, will present proposed measures of the Oregon Hydroelectric Commission. After the conference has approved or amended it, a committee probably will be named to see that the bill is put into the hands of the proper committee in the legislature. The general problem taken up at the conference will be that of increasing the utilization of Oregon water powers.

Hydroelectric districts, if authorized by the legislature, will be composed of cities and their tributary watershed areas. They will be empowered to finance by bond issues their own water powers. The theory of the commission is that such procedure would bring electricity into more general and cheaper use on the farm, in the factory and in the town.

Charles C. Warner, consulting civil engineer, will discuss aspects of the hydroelectric problem in Oregon; W. H. Crawford, Portland, superintendent of Chas. C. Moore & Company, engineers, will talk on the Ontario hydroelectric commission, and give data on costs of power to consumers of electrical energy gathered from a world survey made by the Oregon Hydroelectric Commission; J. L. White, Albany, Oregon, manager Oregon Power Company, will speak on Electricity in Rural Districts. A representative from Hood River will speak on the need of a district hydroelectric law. As a representative from the Rogue River Valley, Porter J. Neff, of Medford, will discuss rural needs for an improved rural district law. A representative of the Portland Commercial Club, E. L. Thompson, will talk on the position of the club in this matter. Representatives of the power companies will discuss the power problem in general and proposed measures. Hon. L. D. Huston, state senator, will speak on national regulation of hydroelectric power.

Charts to show the alleged hap-hazard relations of the various boards, bureaus and commissions of the state adminis-

tration will be exhibited at the conference. Other charts will be presented to show how, by certain groupings, many scattered administrative agencies may be brought under a central head in each case.

TRADE NOTES.

The business of the Hinton Electrical Company, Victoria, B. C., has been taken over by C. F. Carter and C. C. McKenzie, two former employes of the firm.

Apfel & Jansen, electrical contractors, recently installed the Apfel System of electric heating in the general offices of the Pacific Hardware & Steel Company at Seattle.

J. H. Stout has purchased the entire stock of the Bliss Electric Company of Wenatchee, Wash., one of the largest businesses of its kind in the state. F. U. Bliss, the former owner, is not ready to announce his plans for the future.

NePage, McKenny & Company, electrical engineers and contractors, with headquarters in Seattle, report that they have closed the contract for complete electrical installations in the Meier & Frank Building in Portland, Oregon, including light, power, intercommunicating telephones and signal systems. The contract price is approximately \$40,000. This company also reports the closing of a contract for the complete electrical installations in the club building of the Sons and Daughters of Norway in Seattle.

P. D. C. Bell has recently purchased for the Needles Ice Company, Needles, Cal., two Busch-Sulzer Diesel engines. This purchase, which was made after a complete and thorough investigation of every economical type of prime mover, was concluded after a recent trip East by Mr. Daniel Murphy, president of the company. The larger Diesel engine purchased, of 500 brake horsepower, will be belted to a 125-ton Ball ammonia compressor, and the smaller engine, of 120 brake horsepower, will be direct connected to an alternating current generator, and will be used to supply power for the auxiliaries in this raw water ice plant. Both these engines are of the Busch-Sulzer Bros. 4-cycle, 4-cylinder Type B design. They have enclosed crank cases with large doors, which give the greatest accessibility to the parts within requiring inspection. The air compressor is integral with the engine, means for effective cooling of the air between stages and after compression and for the extraction of moisture being provided. Forced lubrication by a rotary positive displacement pump is provided. The following parts are cooled: Cylinders, cylinder heads, exhaust valves, cooler, compressor, exhaust piping and pistons. This will be a notable installation. It is the first instance where the highest type of Diesel oil engine will have been installed for the operation of a raw water ice plant in the State of California.

A contract has been entered into with the Standard Underground Cable Company of Pittsburgh for the following quantities of underground cable for use in the installation of the light and power distribution system in the permanent Panama Canal villages: No. 6, single conductor, varnished cambric insulation, lead covered, for 2300 volts, 23,000 feet at \$8.90 per 100 feet. No. 4, single conductor, varnished cambric insulation, lead covered and armored, for 2300 volts, 15,000 feet at \$14.70 per 100 feet. No. 6, 3-conductor, varnished cambric insulation, lead-covered, for 2300 volts, 7000 feet at \$23.30 per 100 feet. No. 4, single conductor, varnished insulation, lead-covered, for 2300 volts, 26,500 feet at \$10.10 per 100 feet. No. 00 3-conductor, varnished cambric insulation, lead covered, for 2300 volts, 10,670 feet at \$47.50 per 100 feet. The underground light and power system will comprise a conduit line, together with manholes, which are of two types, a cable pulling manhole, and a subway transformer manhole. The cable pull manholes will contain cables and their splices and taps only. The transformer manholes, in addition to being provided with a subway transformer, will contain cable end bells, a 3-wire primary bus,

bus wire supports, subway type cutouts, and cables. The cable end bells and bus wire supports are for use in supporting the 3-wire primary bus, which lies in a horizontal plane. Single phase connections will be made to the bus, and from the bus connections, through subway type cutouts, to the transformer terminals. The system of primary distribution will be 3-phase, delta-connected, 2200 volts, at a frequency of 25 cycles.

WASS-HAEL.

The following invitation has been sent to 200 prominent members of the electrical and mechanical fraternity of San Francisco:

ESTEEMED SQUIRE GREETINGS

Yr gude companie is agayn bidden to join with ye blades in observing ye antient festival of

WASS-HAEL.

Be prompt in ye grate dining hall at ye signe of Bergez-Franks in olde Bush Street at one o'clock afternoon
SATURDAY, DECEMBER NINETEENTH, NINETEEN

FOURTEEN.

Yr stewart hath counselled with Camille who brings rare cookery from Flanders and ye Brewers of Fine Beers.

Hath sent thr Kellerman with carts of Nut Brown Ale since wyne do sate our heads and bellies, and of our feast no one shall gainsay he hath had a better fill.

Fiddlers, Harpers and Pipers, the damn beggars, will play lively tunes and ye young bucks will make merrie with the jests while ye Runnymede Hunters with the Horn and Tally-hos will thrill yr heart and stir in yr vaynes ye red blood of yr forefathers.

GOD REST YE MERRIE GENTLEMEN

As yr fund of our pleasure yr bit shall be twelve shillings and yr chair shall be held a fortnight but no longer since our limit be two hundred and no more and yr prompt acceptance will greatly assist yr obedient servants:

T. E. Collins	R. L. Eltringham	H. G. Aylsworth
N. K. Cooper	W. L. McKinley	H. H. Cudmore
H. H. Daley	T. C. Morris	K. J. Dazey
E. I. Moldrup	A. E. Rowe	Alan E. Morphy
L. A. Somers	H. E. Sanderson	F. H. Poss
J. S. Thompson	A. Emory Wishon	A. V. Thompson

In connection with this an interesting program has been prepared with local talent participating, of which the following is merely a hint:

PROGRAM.

Jos. S. Thompson, Highland Laddie, who will make Harry Lander jealous.

Frank Fowden's silvery voice will be heard once again.

Al C. Joy, monologue.

Runnymede Quartette in hunters' costume—H. H. Daley, F. H. Poss, Jas. Hunt and T. C. Morris—dispensing harmony.

A. V. Thompson, screaming monologue—Messenger Boy No. 23.

Italian Troubadour Trio—Sweet Songs of Sunny Italy.

Derico's Harlequin Band.

Jas. Lemon, Scotch Piper.

Chauncey Montgomery, Chinese Impersonator.

Cudmore & Clark—Sketch, "The Traveling Salesman."

And others.

Special Menu Features.

LETTER TO THE EDITOR.

Sir:—Since certain publicity has been given the Wass-hael festival in the daily newspapers wherein the name of one company was featured, it becomes necessary for me to say on behalf of the committee that we have ever studiously avoided any featuring of the affair which could be construed in any way as an effort to give publicity to any one company for commercial purposes and this committee will never tolerate any other present or future course. In justice to the gentleman at whose instance the newspapers published their accounts it is also fair to say that nothing in his communications to these editors which, I have read subsequently, justifies their mentioning the company he represents and I have the assurances of the gentleman that no one regrets the unfortunate error any more than he does. Will you kindly favor us with a share of your valuable space for the publicity of this explanation, for which we will thank you.

Very truly yours,

T. E. COLLINS.



NEWS NOTES



FINANCIAL.

SEATTLE, WASH.—The question as to whether or not the City of Seattle was within the law in appropriating \$25,000 to rehabilitate and operate the Lake Burien street railway line, extending three miles beyond the city limits, will be tested by the state in an action by the state bureau of accountancy.

OAKLAND, CAL.—Opposition to the plan to refinance the Oakland, Antioch & Eastern Railway by asking bondholders to accept notes in lieu of interest payments for three years, is being organized by a committee composed of Louis T. Hengstler, C. W. Merrill, Howard D. Smith, W. M. Alexander, W. H. Harries, Thomas S. Baker and Louis Rosenthal.

OAKLAND, CAL.—A committee representing the holders of the 5 per cent general mortgage bonds of the Peoples Water Company has entered a protest against that feature of the so-called Van Sicklen plan of reorganization under which they are asked to surrender their bond holdings in exchange for common stock in the company on the basis of \$1100 in common stock for each \$1000 bond. Their objection is based on the fact that under the California law their stock would be assessable, and they want the plan amended so that this danger may be obviated. The committee has taken the objection under advisement.

SAN FRANCISCO, CAL.—A plan for the reorganization of the United Light & Power Company is being worked out by a committee of the security holders and signatures are being secured to an agreement to exchange the 6 per cent bonds of the old company for 5 per cents in a new company, the payments both as to principal and interest to be guaranteed by the Great Western Power Company, which, if the reorganization is effected, will take over the properties and the contracts of the United company and work out economics which are expected to put the new company on its feet again. E. W. Wilson, manager of the International Banking Corporation, is acting as transfer agent for the committee, which is headed by Mortimer Fleishhacker.

CALDWELL, IDAHO.—The meeting of the citizens of Wilder and Greenleaf with representatives of the Caldwell Traction Company this week resulted in the adoption of a definite plan for raising money necessary to electrify the Wilder branch of the Oregon Short Line. Under the plan adopted by the delegates, the residents of the Greenleaf-Wilder section agree to purchase twenty thousand dollars' worth of Caldwell Traction Company bonds, the amount subscribed to be used in the electrification of the Wilder branch. The bonds bear 6 per cent interest and are secured by the Deer Flat line of the company, its contemplated improvements on the Wilder branch and terminal facilities in this city. The remainder of the amount necessary to electrify the road, which it is estimated will involve an expenditure of approximately fifty thousand dollars, must be met by a subscription of the bond issue by the citizens of Caldwell. The residents of the section tapped by the Wilder branch are vitally interested in securing the electrification of the line, as was evidenced by the statements made by the prominent farmers in attendance. The unanimous opinion expressed was that the contemplated improvement would be the greatest immediate benefit for the people directly affected, because of the improved marketing facilities and the increase in land values. A committee of three Wilder citizens and three from Greenleaf was appointed by Chairman Peckham to dispose of the bonds among the land owners, and it was the expressed opinion of the committee that the necessary amount would be subscribed within two weeks.

ILLUMINATION.

RED LODGE, MONT.—The question of an ornamental lighting system is under consideration.

PHOENIX, ARIZ.—The city commission has decided to put new lighting standards on North Central avenue.

BAKER, ORE.—The question of a bond issue of \$97,776 for the installation of a lighting plant, is before the council.

SAN BERNARDINO, CAL.—The board of supervisors has rescinded action creating the Del Rosa Lighting District.

LOS ANGELES, CAL.—The board of supervisors is taking bids for the improvement of the Westgate Lighting District.

RIVERSIDE, CAL.—The contract for the installation of an ornamental lighting system on Seventh street has been awarded to the mayor for \$4611.89.

SEATTLE, WASH.—The council has accepted the bid of Carstens & Earles at par and accrued interest for the purchase of \$404,000 light extension bonds.

WALLA WALLA, WASH.—Mayor A. J. Gillis and Commissioner George Struthers have investigated the street lighting system and as a result many new lights will be installed.

VANCOUVER, B. C.—Preparations are being made by City Electrician Fletcher to undertake the lighting of the new Hastings street viaduct. The lamps used will be the new nitrogen filled type.

SOUTH PASADENA, CAL.—The board of trustees has awarded the contract for the construction of the ornamental lighting system on Fair Oaks avenue to the W. W. McNalley Company, of Pasadena, for \$15,948.

LOS ANGELES, CAL.—Proceedings declaring the intention of the city to order the necessary appliances to be installed and electrical current furnished for lighting a certain portion of Main street, has been abandoned.

SEATTLE, WASH.—Mayor Gill vetoed the council bill passed recently for the extension of the city lighting system to Tukwila, Foster and contiguous territory, at a cost of \$10,000, the sum to come from the light fund.

SANTA MONICA, CAL.—The city council has awarded the contract for the construction of the ornamental lighting system in Colorado avenue between Ocean and Fourth streets, to the J. D. Koon Contracting Company for \$2100.

BAKER CITY, ORE.—Engineer Stockman has presented his report on the proposed pipe line improvements to increase the capacity of the municipal lighting plant to the commission. The estimated cost of the work is \$180,540.12.

TACOMA WASH.—Electrical Superintendent Collins announces that plans are rapidly nearing completion for the increased illumination of the semi-business and residence districts of the city. The new lights will be of the luminous arc type.

HELIX, ORE.—The Freuler & Dyer Engineering Company, Walla Walla, have interested local capital in the question of an electric light plant and work will start within a short time. It is the intention to add an ice plant in the spring with 4 tons daily capacity. The plant will be 22 h.p. crude oil engine with 20 h.p. generator. The streets are to be wired for light.

TRANSMISSION.

SPOKANE, WASH.—The Western Union Mines Company, recently organized by J. L. Barber and E. D. Reiter of Republic, and others, has authorized the advertisement for bids for constructing a central power plant at Republic, capable of generating not less than 1000 horsepower.

EL PASO, TEX.—A. B. Graham of the Parsons Mining Company, South Bend, Ind., is in Carrizosa, N. M., looking after the interests of that company. Right of way for their new power transmission line from Manchester to the mines is being secured and a contract for its construction has been let.

VANCOUVER, WASH.—Notice has been filed with the county auditor of the appropriation of 500 cubic feet per second of the water of the east fork of the Lewis River by J. H. Cunningham. The water is to be used for hydraulic and electric power for municipal lighting, manufacturing and other commercial purposes.

SAN FRANCISCO, CAL.—Mayor Rolph has been authorized by the supervisors to enter into an agreement with the Exposition Company, whereby permission is granted the Exposition officials to use a lot at Grove and Polk streets in the Civic Center property as a site for a temporary power house for a period not to exceed 12 months. The building will be used to supply power to the municipal auditorium.

SEATTLE, WASH.—Superintendent of Lighting J. D. Ross is urging the construction of a new unit to the Cedar River power development project by day labor, under city supervision, rather than by contract work. Ross declares that the emergency force which is kept constantly on the ground could do much of the work of clearing the land and sluicing this winter, while at the same time keeping guard against floods and breaks at the pipe line.

LEHI, UTAH.—Lehi may own its own municipal power plant. Mayor W. F. Gurney and Councilmen W. S. Evans and William Wing have filed on a power site in American Fork canyon at the mouth of Deer Creek, where, it is figured, 1500 horsepower may be developed. The filings call for two pipe lines, one from the main canyon and the other from Deer Creek, to be 18,000 and 5000 feet long, respectively, which will carry the two streams into a reservoir to be built on Silver Lake flat, which reservoir, the filings say, will be connected with the power plant by a steel pipe line 7542 feet long. It is estimated that the plant will cost \$150,000. The officials disclaim any present intention of building the plant until after a bill has been gotten through the legislature giving cities of the third class greater bonding power. Even then the propositions will be first submitted to a vote of the taxpayers.

BEAVER, UTAH.—The Beaver River Power Company announce that the new electric power line to the Moscow mine in western Beaver county, will be ready for operation by December 1st. The electrification of this famous silver producing property means a greatly increased production for the mine. The increased use of power by the Moscow mine as well as by other properties in this county will probably require the installation of an additional plant by the Beaver River Power Company to take care of its increased demand. Although the company now has 2000 horsepower available for distribution purposes it is quite likely that the increasing demand from the various mining enterprises in Beaver, Millard, Sevier, and Piute counties will necessitate the construction of another power plant on the Beaver River on a site held by the company some five miles below the present plant. This additional site is capable of developing 3000 horsepower.

SALT LAKE CITY, UTAH.—Power from the new Granite County Power Company's plant, which will generate a pressure of 6600 volts and which will be transmitted a distance of approximately six miles to the Royal Basin Mining & Milling Company's property, located at Royal Basin, Mont., is expected to be delivered at the first of the year according to John D. Fields, manager of the Royal Basin mine. G. T. Hansen of the Allis-Chalmers Company wired George Polzin, erecting engineer for the company, to start immediately

for Montana to superintend the installation of the electrical machinery which is now on the ground. According to Mr. Fields' letter, the pipe line which carries the water from Fline and Boulder Creeks, a distance of 2600 feet, has been completed. The dam has also been completed, as well as the surge tanks that were erected in order that the changes in pressure due to opening and closing of the gate of the turbine might be regulated. Writing of his electro-chemical method of recovering gold, silver, copper, lead, zinc and other values from ores, which method is now in use at the Royal Basin mill, Mr. Fields said that they were literally swamped with concentrates and that, though they had planned to withhold shipments until a better price was quoted, they would be forced to ship in the near future or be compelled to erect other storage bins. He also stated that a large amount of electrolytic copper was on hand, which was being withheld for the same market reasons. The power from the new plant will be utilized in driving the grinding machinery, furnishing energy for use in the Fields process, and it is also the intention of the company to operate the mining equipment with electric power. Several small towns in the vicinity of the mine will be furnished power and light, and the line may eventually be extended to Drummond, Mont., the present motive power in use is steam.

TRANSPORTATION.

NOGALES, ARIZ.—Additional time has been granted to the franchise committee to report on an electric car line franchise under consideration.

VALLEJO, CAL.—President A. D. Bowen of the Vallejo-Benicia Railroad, spent some time here with City Attorney W. T. O'Donnell, to whom he turned over their application for a franchise to enter this city.

SEATTLE, WASH.—According to the figures on file in the office of the Seattle public utilities commission, the Lake Burien street railway line has gone behind \$2100 since July, 1914, when the service was installed. This does not include the charges for power.

SEATTLE, WASH.—The Chicago, Milwaukee & St. Paul Railroad Company announces that a contract has been awarded to the General Electric Company for the electrification of its line from Harlowtown, Mont., and Avery, Idaho, a distance of 430 miles. The contract price is \$2,000,000, and includes nine freight and three passenger locomotives.

DIXON, CAL.—An official of the Sacramento Valley Electric Railroad says there is enough money subscribed to complete the second unit of the road from Dixon to Woodland. It may be necessary to bring suit to collect some of the subscribed funds. The survey has been completed to Woodland, and as soon as the money is available construction work will be resumed.

OGDEN, UTAH.—The Utah Construction Company still has two large camps in the Cache Valley on the construction of roadbed for the Ogden-Logan & Idaho Railway Company. Building operations for the company have not yet been completed and it is likely that most of the early part of next season will be taken up in construction work in connecting the Ogden and Logan divisions of the interurban road. Manager P. D. Kline has returned from the north with the report that the roadbed to Lewiston will be completed and that within the next ten days the road will be ready for the operation of cars. The wiring has been completed and electrical equipment placed in position. Three interurban cars will be shipped December 2d, and Mr. Kline states that they will reach Logan by December 14th. He expects that on the following day the Cache Valley schedule will be put into effect from Lewiston to Wellsville. All the road south of Logan is ready for the cars.

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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VOL. XXXIII No. 25

SAN FRANCISCO, DECEMBER 19, 1914

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EGYPT AND CALIFORNIA.

BY A. E. CHODZKO.

ELECTRICAL OPERATORS.

BY O. C. BANGSBERG.

INDUSTRIAL USES OF FUEL OIL.

BY F. B. DUNN.

REPORT OF OREGON ELECTRICAL CONTRACTORS'
MEETING.

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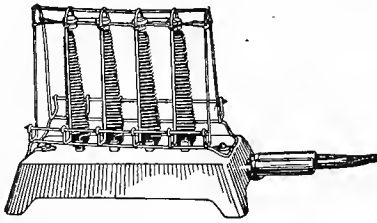
"Phono," Pierson, Roeding & Co.

Wire and Cable

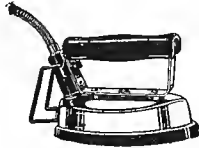
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CHRISTMAS—this year

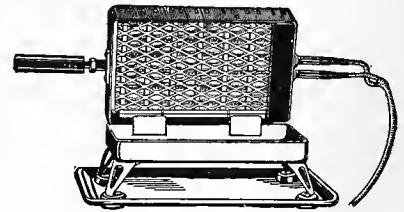
it's to be more of an electrical
season than ever before



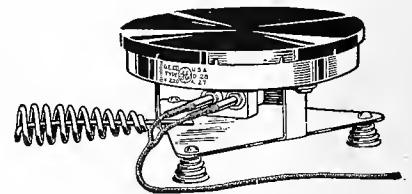
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Encourage your people to make it electrical in your section.

Display and demonstrate to them the advantages of making useful gifts and of having in the home



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Favored on the part of the housewife—real unshakable favor—because they meet the practical demands of the home, the hard knocks and wear and tear of every-day use.

It is their absolute dependability—stability—the high quality of material—fine workmanship and careful construction that have won for G-E Heating appliances permanent favor.

Those pictured here are only a few suggestions from the line. We will be pleased to mail you a catalogue or send our representative to talk with you.

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EGYPT AND CALIFORNIA

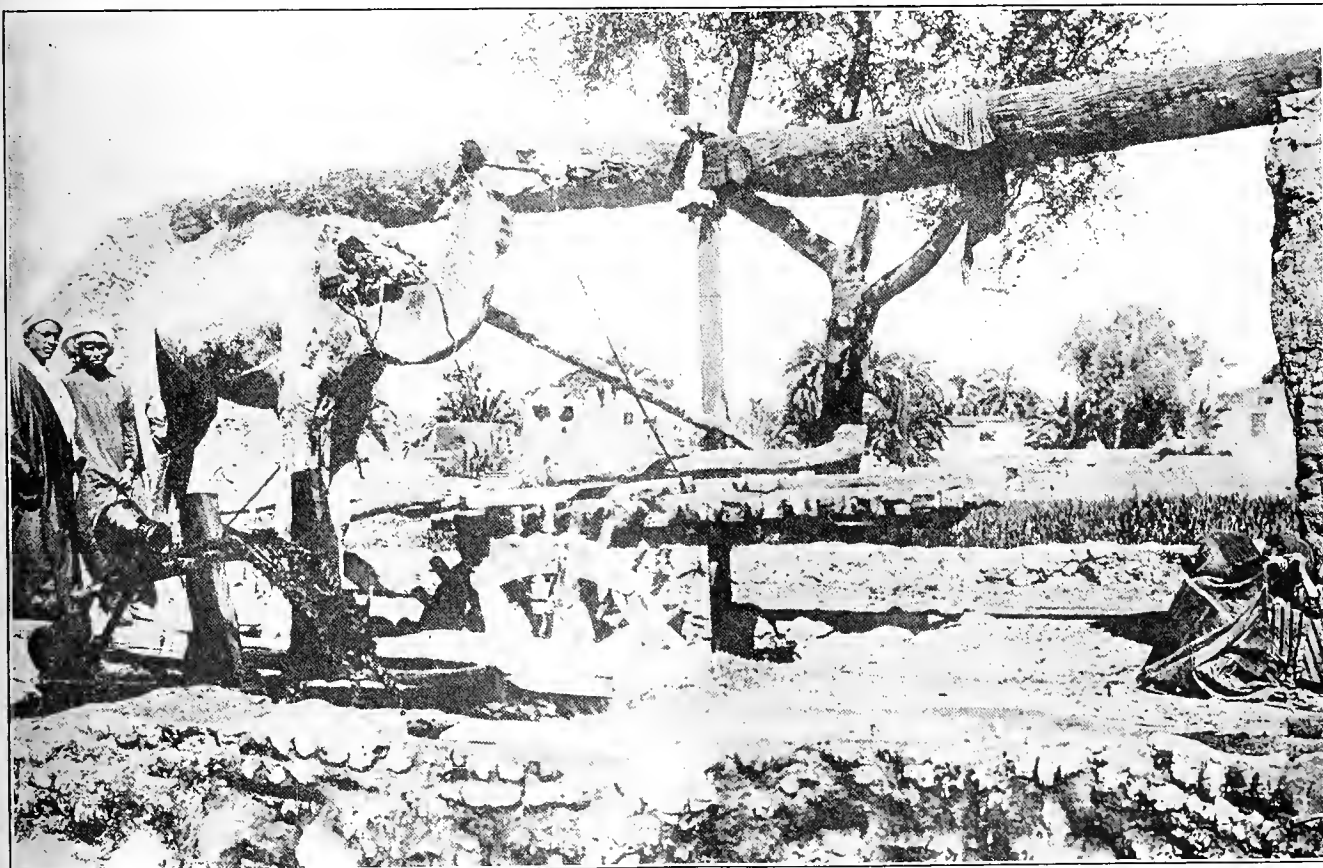
BY A. E. CHODZKO.

(This article describes conditions in Egypt which are similar to those found in several places on the Pacific Coast. A peculiar interest attaches to them because of the entertaining way in which they are described by the author and because of the increasing use of rice culture in improving alkaline lands. The author is a consulting engineer at San Francisco.—The Editor.)

California has so liberally been endowed with the natural elements of wealth that many of its citizens unconsciously overlook the fact that large portions of that privileged land are still open to substantial

the existence of an already full grown, yet so far unsuspected industry.

These remarks have particular reference to the cultivation of rice in California, particularly in Butte,



Egyptian Sakieh for Irrigating Rice Fields.

improvement, before they can be entered among the prosperity assets offered to the intended investor. One result of this not unnatural tendency is that little, if anything, is known by the general public of systematic attempts by the Federal Government to add new staples to the list of merchantable produces of California, until its attention is occasionally called to

Glenn and Yuba counties, where 16,000 acres have already been devoted to this purpose within the past four years, and as much more now is in immediate contemplation.

Rice plantations are all but a novelty in the United States; their recent development on the Pacific Coast is, however, of special interest, owing to

the similarity of physical conditions between some of its inland valleys and the Egyptian Delta, where the writer happened to be, for several years, connected with that same kind of culture on an extensive scale; it is assumed that a few reminiscent remarks on the subject might be of passing interest. They are, of necessity, limited to the technical side of the subject; the difference of times, of customs, and of working methods would deprive commercial considerations of any useful feature.

Egypt has, from time immemorial, and still is, an essentially agricultural country, of proverbial fertility. This is due to the perennial accretion of virgin ground, furnished by the large proportion of organic sediment carried at all times in suspension by the waters of the Nile. That huge stream, the only source of supply in the land, reaches Cairo after a course of some 4000 miles from Lake Victoria Nyanza, and at a short distance below that city it forks into two branches, emptying into the Mediterranean, one to the west, at Rosetta, the other to the east, at Damietta.

The cultivated portion of the valley of the Nile is only a few miles in width, except at the base of the triangular expanse extending between and on either side of the two branches, and known as the Nile's Delta. Both above and below Cairo the abrupt transition from the green crops of the cultivated land to the arid sand dunes of the desert is a striking feature typical of those localities.

The Nile is subject to periodical rises, the high water reaching the Delta from three to four months after its occurrence in the great central African lakes, and that period, which happens in the late summer or early fall, is one of intense excitement among the neighboring towns and villages; the levees are guarded day and night by hundreds of thousands of natives, along both branches of the river. At the peak of the flood the level of the swirling, muddy waters reaches close to the crest of the banks, and high up above the surrounding lands; full well do these men know that with levees made out of alluvial sediment a slight leak through a gopher hole or through a tiny crack very soon increases into an uncontrollable torrent, and has sometimes been followed by the submersion of entire provinces.

That mighty current, rolling seaward a volume of 495,000 second feet, presents, indeed, an interesting sight, as also does the alacrity of the crowd of watchers, ever ready to pile up at some threatened point great sacks of chaff, stacked to that effect along the levees.

The main streams of the Nile are tapped by a great number of large and small laterals, which distribute their waters over the plains; some of them are of considerable size, as, for instance, the Mahmoudieh Canal, that shoots from the left bank of the Rosetta branch, to supply drinking water to Alexandria, some 45 miles distant. Less trouble exists, therefore, in providing abundant irrigation during the flood period than in safely controlling its volume; but during the low water season artificial means often have to be adopted to insure an adequate supply.

Such a great disparity of flow could not fail from arousing attention, in a land replete with indications

of a high development of civilization at the remotest epochs in human history; there is no question but that attempts were made on a large scale to store up part of the flood waters for the dry season.

Lake Moeris, a sheet of water 34 miles long by 4 miles wide, in the province of Fayoum, some 60 miles above Cairo, is believed to have been part of such a project, as well as remnants of canals, more or less filled up by the sands of the surrounding desert, and supposedly contemporaneous with the biblical days of Joseph and of the Pharaohs. The magnitude of these vestiges bears testimony to a remarkable state of technical advancement.

A dam of modern construction has for many years existed across the Nile, a short distance below Cairo; its impounding qualities were, however, greatly impaired by its leaky condition, when, in 1898, construction work was begun on a large dam at Assouan, Upper Egypt, 700 miles above the mouth of the river. That work was completed in 1902, and secured a storage capacity of 863,000 acre feet, covering an area of 40,000 acres. At the same time a diverting dam was constructed across the Nile at Assiout, 339 miles below the former. It has since been decided to raise the Assouan dam to a sufficient height to double its storage, a decision, by the way, distasteful to the archaeologists, as it will mean the submersion of the ruins of a well-known temple on the island of Philoe.

The impounded water is mainly used on important cane and cotton plantations in Upper Egypt, most of them government and crown lands. In the Delta, and during the low water season, the necessary supply for irrigation has, in many localities, to be obtained by artificial means.

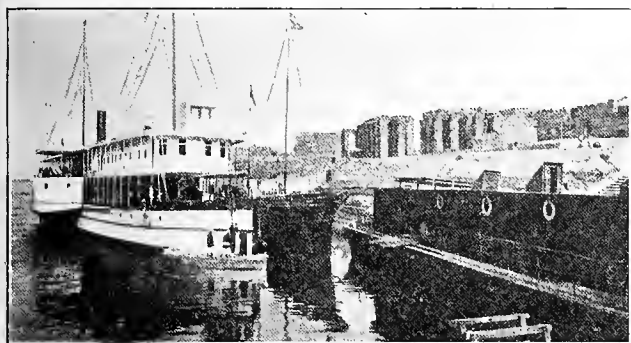
The Delta is practically level, with a slight slant towards the Mediterranean. The surface of the plain is occasionally broken by low hillocks, or "koms," of limited extent; those mounds are accumulations of debris and of broken bricks, the remnants of ancient towns and villages gradually annihilated by the repeated action of sun, wind and inundations. The flood waters, collecting against the sand dunes of the beach, naturally had to find an exit more effective than evaporation, and thus were formed shallow lagoons of large area with a seaward outlet through the sandy shore.

Such are Lake Mariout, with an area of 50,000 acres and an average depth of 3 feet; Lake Bourlos, of approximately similar size, and the larger Lake Menzaleh, terminating near Port Said, the northern end of the Suez Canal. These lakes, extending inland into a ramification of sloughs, serve as natural drainage collectors for the adjacent territories. Under ordinary circumstances, lands could therefore be irrigated by gravity between the bank of the Nile, or of some lateral, and the level of the nearest lake, and even during the low water season, this never falls much below the irrigation canals, say 10 to 14 feet; and therefore, the problem of artificial water supply generally defines itself by a variable capacity and a low pumping head.

This requirement is often met by the shadouf or the sakieh, two specimens of native engineering little different today from what they were many centuries ago. The shadouf is made of a bucket of any material,

wood, clay, woven straw (and in modern designs, 5-gallon coal oil cans) suspended to one end of a pole and counter-balanced by a lump of mud. It is operated by hand, see-saw fashion; these scoops are often used in series.

The sakieh belongs to the "noria" type of pump; it consists of an endless rope, with earthen pots attached 2 or 3 ft. apart, passing over a spider connected to a horizontal shaft, itself operated through bevel gearing by a vertical post, to which is hitched a camel or water buffalo. The shafts are rough pieces of logs stripped of their longer limbs, resting on portions of forked trunks in lieu of bearings; the gears are made of an indefinite number of wooden plugs, of arbitrary shape, set along a wavy, circular



Landing Place at Luxor, on the Nile.

curve. The use of sawed lumber and of a square is conspicuously avoided, and the mention of that ancient contraption will doubtless evoke a familiar sight in the memory of the former tourist or traveler. A variegated gamut of creaking sounds invariably accompanies its operation, and acts as a record of the activities of the team, drowsily pacing its circular track, in the midst of a cloud of flies, during the hot, sunny days. Eventually the soporific effect of that lullaby is proving too much for the power department, and the melody dies out by degrees, until the engineer in charge, slumbering on the double-tree and roused from his dreams by an ominous silence, starts up the motors with a wealth of expletives, for which the Arabian race has long since won a deserved fame.

These, however, are relics of the past, and many modern plants are found both along the river and the canals; a centrifugal pump operated by a portable steam engine constitutes a general type of outfit, while in some cases the installation assumes a character of permanency. Such, for instance, is the case, already mentioned of the Mahmoudieh Canal, which carries drinking water to Alexandria, and at the same time is used as the main artery of supply for the irrigation of that portion of the province of Behera, extending west of the Rosetta branch, between that stream, the sea and the Libyan Desert.

The pumping plant is at Khatatbeh, where the canal joins the river, and a first installation consisted of a battery of inclined Archimedean screws, laid side by side, and actuated through bevel gearing at the top by a common countershaft running alongside. These screws had a barrel of steel plate about 10 ft. in diameter by 40 ft. in length, with inside riveted helical spires; they gave considerable trouble, owing

first to the difficulty of protecting the foot step from the grit in muddy water, and second, to the shearing of the rivets under the inertia strains created by such a large moving mass of water.

That plant was removed and superseded by centrifugal pumps from the firm of Farcot & Co., St Ouer, near Paris. Their dimensions and their capacity warrant a short description. The station comprises five of these pumps, each with a vertical shaft driven by a separate single cylinder steam engine of the Corliss type (39.37) in. in diameter, with a stroke of 5 ft. 10.8 ins. The lift is 10 ft., and the capacity is 95,400 gal. at 32 r.p.m. in normal work, the speed being variable between 16 and 42 r.p.m. The runner measured at tips of vanes is 12 ft. 5 in., and the casing is 19 ft. 8 in. in diameter, and nearly 12 ft. high, resting on six cast iron columns.

The single inlet has a diameter of 6 ft. at the throat increasing to 9 ft. 10 in. at entrance. The discharge flow controlled by a sluice gate has a velocity of less than 2 ft. The useful work of the pump is 65 per cent of the indicated horsepower.

Another type of modern pumping plant will be described further on; the influence of that subject on the reclamation of arid lands is closely connected with the economical generation of motive power; in Lower Egypt labor is cheap but power is expensive. Victoria Falls, on the Zambesi River, are very far off; the nearest source of hydraulic power, the cataracts of the Nile, are more than 1000 miles away, and they remain to be harnessed for that purpose.

Neither coal, nor oil, nor forests exist in that region, and while small pumping outfits are using all sorts of vegetable trash as steam fuel, the same is out of the question for operating a large stationary plant, and imported coal is the only available and very costly recourse.

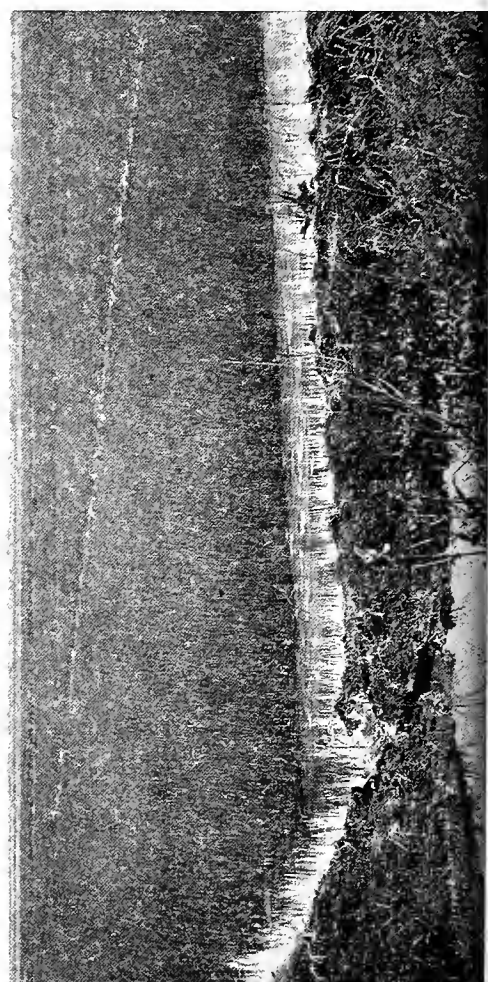
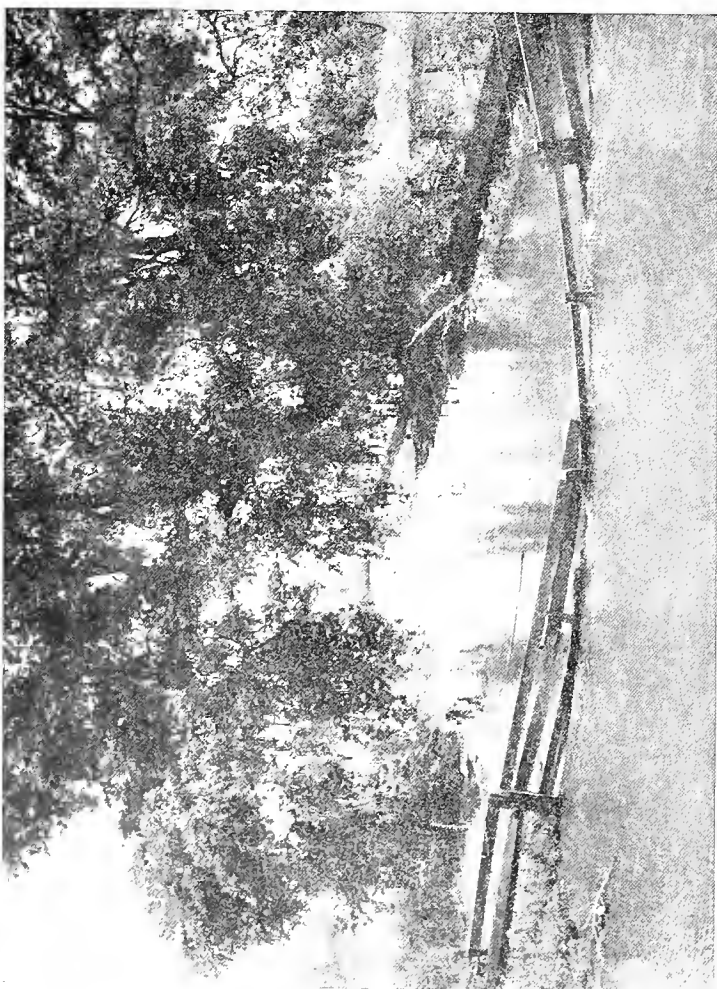
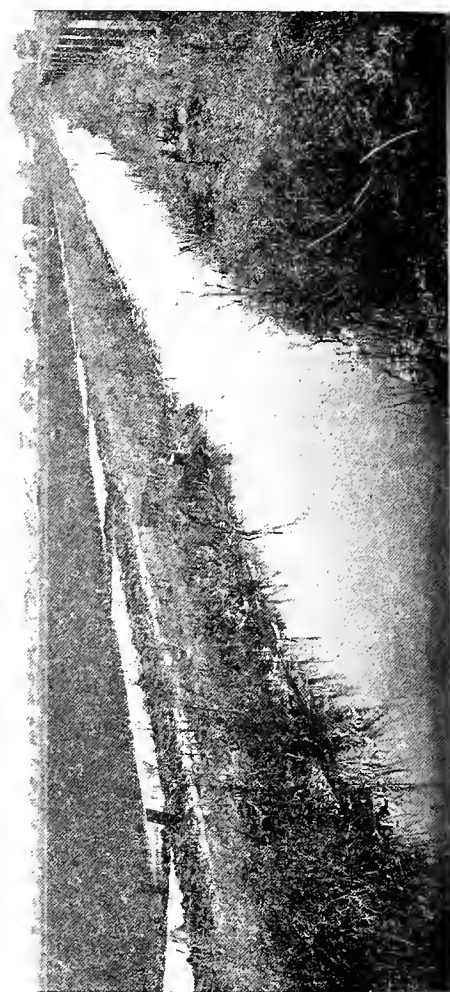
In California the conditions are reversed, since labor is expensive, while motive power, in one form or another, is, in many cases, available on an acceptable basis.

The regular crops in the Egyptian Delta are mainly cotton, rice and also, on a smaller scale, corn



Typical View of the Modern Nile.

(doura) and clover (bersim); on lands that have been under regular cultivation the logical course to follow is, of course, associated with a proper rotation of crops, the exhausting influence of any particular one being, as already remarked counteracted by the renovation due to the sediment in the irrigation water.



But when new ground is to be prepared for the staple cotton crop, it frequently happens that it is found prohibitively saturated with alkaline salts, and the soil must first be scrubbed, or washed, before the cotton seed may safely be planted to it. In such cases—and they occur on vast areas—rice, while never



Water Buffalos, the Ancient Egyptian Motor.

being considered a negligible quantity, becomes, in the present instance, a sort of by-product, the primary object of its cultivation being to cleanse the alkali-permeated soil, and to make it fit for the cotton crop; but that same principle is true of any other crop that could not be raised in the alkaline soil, and therein lies the connecting link between the American West and Lower Egypt, because a similar problem would frequently be met in the reclamation of arid lands in this country; such was the particular point in view when presenting an apparently irrelevant narrative of methods in use far abroad. The philosophy of the process is to turn the expense of making a barren soil fit for cultivation, to profitable account, by deriving from that preparation a merchantable produce.

Now, this scrubbing operation implies the influence of percolation, of capillarity, and inductively, of the rate of irrigation. An indiscriminate use of water may be detrimental to the productivity of certain soils, albeit well adapted to other portions of the land, even in the same vicinity. The proper rate should be determined by experiment, in any given soil, which is, perhaps, asking a great deal of the average farmer, who has many irons in the fire and scant leisure for experimental work.

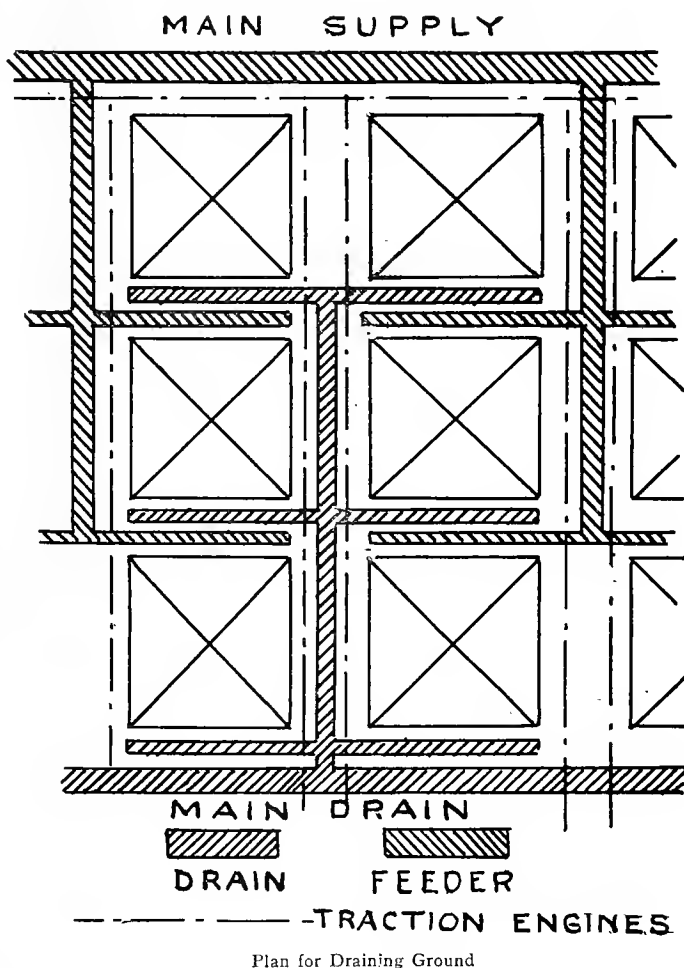
On the Egyptian plantations, under European management, the solution was sought in what might be termed intensive drainage.

Given an unlimited quantity of water in an irrigation canal, its rate of percolation through a given level field varies with the vertical distance from its surface to that of the drainage. The term "level" field is used advisedly in the case of rice; it is, of course, supposed that a homogeneous seed is put on a field of homogeneous composition, and that a crop of uniform growth will be the result. The immersion of the stalks must therefore be the same all over the field. In the washing process the water must remain on the ground long enough to dissolve part of the objectionable salts, yet not long enough to become saturated, and the horizontal flow will be

regulated to that effect; this will take care of the salt that has accumulated at the surface of the soil, and also that has been creeping up by capillarity, but part of the water must sink under the surface and wash the soil by percolation, and this action is regulated by bringing the water line in the drainage to a point that must vary in different fields, as also in the same field at different times, and consequently that must be controllable.

To that effect a drainage collector of sufficient depth is equipped with a pumping outfit, discharging into the lake; in other words, as artificial means are used for the supply of the irrigation canal, so are they provided to control the water level in the drainage collector.

This, of course, introduces an additional element of expense, but it also minimizes the water supply, and permits of use at the most favorable moment; at the same time every available labor-saving device was resorted to—ditch-grading, field-leveling, ploughing were done by machinery. The accompanying sketch imparts an idea of the disposition of the fields,



Plan for Draining Ground

divided up into squares of about 500 ft. side. A crew of two traction engines, moving on the roads at opposite ends of a field, and pulling the scrapers or the gang plough back and forth, would do, in the same time, far more satisfactory work than 120 yokes of oxen.

Moreover, the uses to which a traction engine of moderate size, and in the hands of a good man, can be put to good advantage are, indeed, quite a few.

It will, as stated, operate graders, ploughs and harrows; it will haul heavy loads along bad roads, and unload them on the cars at the railroad station; with a couple of guides attached to the same crane jib, it will act as a pile driver, or else, operate a pump, a circular saw, a fodder chopper, or a dynamo.

Some classes of work, like weeding, or cotton-picking, must be done by hand; but with the modern use of fuel oil and of electricity, there is little doubt but that cultures of that class on a large scale could be carried out with economy and profit.

A modern pumping plant is being put in at Mex, three miles west of Alexandria. The district west of the Rosetta branch, and which includes the province of Behera, is discharging its drainage water into Lake Mariout, which is open to the sea.

The extension of the cultivated portions to an area of some 2400 square miles has had the result of raising the water level in the lake and of impairing its draining capacity on a portion of the land. The Egyptian Government, therefore, decided to reclaim the lands covered by the shallow waters of the lake, and to dig into its bed a drainage canal of sufficient depth to accommodate not only the present cultures, but the prospective ones due to reclamation. That canal, with a bottom width of 92 ft., is now in process of execution, and a pumping plant has been devised for the drainage of the lake and of that canal. The height of lift is from 19 to 20 ft., and there will be ten pumps, two of them spares. The aggregate capacity of the eight remaining pumps will be 550,000 gal. per minute. The pumps are of the Humphrey's explosive type, and operate by the alternate explosion and expansion of a mixture of air and gas, combined with the inertia of the mass of water set in motion. The description of that device is well known to persons familiar with pumping machinery, and need not be repeated at this place. An idea of the proportions adopted in the case at hand will be gained from the fact that the internal diameter of the combustion chamber is 8 ft. 8 in., with 100 inlet water valves of the hinged type.

The enlarged part of the playpipe has a diameter of 12 ft. Compressors are, of course, attached to the pumps for supplying the explosive mixture, formed of Mond gas and air, the former generated in a plant of the self-vaporizing type, and of a daily capacity of 44 tons of anthracite. The gas holder can store up 10,000 cu. ft.; the plant is contracted for on a guaranteed consumption of 1.15 lb. of coal per water horsepower.

A plant for electric power and lighting is operated by two gas engines of 180 b.h.p. each, direct coupled to 120 l.p. generators, the current being supplied at 225 volts. This plant will be used for the erection of the pumps and for working the centrifugal drainage pumps during excavation. It will be supplied with a temporary suction gas producer plant of 220 h.p. The handling of large volumes of water by direct contact of gases under pressure is a logical step suggested by the enormous size of pumps of same capacity. Air lifts at low pressure would likewise furnish a satisfactory solution of the problem.

LETTER TO THE EDITOR.

What Are We Going to Do About It?

On July 30, 1914, the California Railroad Commission approved the Report by the Joint Committee on Inductive Interference. Following the publicity of this report, we had considerable "fire works" among the "brain shop foremen." Then all is quiet!

As a common ordinary lineman working at the business every day, I would like to say that the Joint Committee is entitled to a great amount of credit for the advanced position they have taken, knowing the subsequent storm would burst about them. And I hope that some day the critics who have so unjustly tried to hold the committee up to ridicule will awaken to the fact that they, "The quidnunc" spoke out of turn. But did the committee go far enough? We say, "No! a hundred times No!"

Let us not deprecate the scientific side of the question. But can we arrive over that route alone? What relief will it give the lineman, the local telephone companies with their patrons and the public at large from the physical hazard?

We will all admit that the physical hazard does exist and should be considered above the scientific side. Chapter 499 of the statutes of 1911 or General Order No. 26 of the California Railroad Commission do not give any relief and General Order No. 39 only such as automatically happens. Absolutely none to the local telephone companies, only indirectly.

Let us not commit the "sin of omission" any longer, let us get something done. Now let us look the proposition square in the face, see where the responsibility rests, and furthermore, put it where it belongs without fear or favor.

My plan is, let the Railroad Commission appoint a committee of linemen (who are actually working at the business, because they entertain the greater portion of the hazard and have a moral right to frame the conditions under which they must labor) to augment the Joint Committee. Let them draft a set of specifications covering all branches of outside electrical construction.

Let these regulations be made retroactive, giving a short reasonable time for reconstruction. Society will gain a much greater security and for that added security let the Railroad Commission allow a sufficient increase of rates that will cover the cost of reconstruction.

This plan looks simple to my lineman mind, and the only true ground on which the problem can be solved.

We have all made mistakes and as long as we advance along constructive lines we will continue to make some errors.

Section 42 of the Public Utilities Act specifically states that it is the duty of the Railroad Commission to safeguard the public and the employee. Is it doing its duty? Look back for a couple of years and see the number of linemen who have been killed and answer the question for yourselves.

How many of us have the spine to put the situation where it belongs? Up to the Railroad Commission! "Am I right?"

O. SANDERS.

212 W. Third St., Los Angeles, Cal.

ELECTRICAL OPERATORS.

BY O. C. BANGSBERG.

(Here is a straight-from-the-shoulder ginger talk on efficient power plant operation. Mr. Bangsberg is chief operator at the Borel station of the Pacific Power & Light Company.—The Editor.)

So much has been written on every subject pertaining to power developments and their operation that the writer thought an article dealing with the operator himself, his qualifications, problem, etc., would be appropriate.

"Men may come and men may go, but I go on forever," seems to apply particularly to the operator's place in a power project. After the site for a development has been located come the engineers for the preliminary survey and estimate, then the interesting of financiers, and finally the complete surveys and final location of the works, followed by construction. Each class of men come, perform their part of the work, and go, leaving the sum total for the operator to assume responsibility for and to operate successfully.

While the operator has had no part in the work until its completion, to be successful he must have a knowledge of all classes of work that is incorporated in the finished product. He must be somewhat of an engineer or he will not know whether he is operating efficiently. He must understand about finances, as applied to a power development, so that he can realize the magnitude of the investment that he must protect, and he must be well grounded in construction work, else how can he hope to operate intelligently the finished product?

"As a man thinketh, so is he," applies equally well to operators, and in the writer's experience, as operator in charge of various plants, it has been hard to reconcile the mental attitude of some of the so-called operators that have passed in review before him. Other qualifications being equal, a man's mental attitude toward his chosen work makes or breaks him, and if his chosen work should be electrical power plant operating, it makes him a real operator or a near operator.

The near operator usually has the training and ability, technically, to make him an operator, but is content to leave things as he finds them and takes the "what's-the-use" mental attitude, contending that as long as he keeps the plant running he will get just as much credit as though he lost some sleep trying to improve the efficiency of operation. Among this class you will find the ones who are always pestering their employers for more wages, failing to realize that if they would only get in and dig increase in wages would come as a matter of course; in fact, the employer couldn't help but raise the man's salary. The writer would not give up the pleasure and satisfaction derived from an unsolicited increase in salary just for the sake of getting the raise a month or so earlier by asking for it. I do not believe that it is ever necessary to solicit an increase in salary, as if a man is saving an employer money and "delivering the goods," so to speak, and the employer does not reward the man properly, there are always other employers who would be only too glad to get the services of such an operator.

But to get back to our subject. You will find

that the near operator occasionally will show spurts of action, but somehow they lack the persistence, which is the key to success. Herbert Kaufman has well said: "Persistence is the key to existence. Success invariably rewards the good fight. Knowing what to do or how to do it won't bring results. Action must drive ability. The nail is useless without the hammer. Courage is the complement of knowledge."

The real operators are the men who, by self-denial, hard work and loyalty, have won the confidence and respect of their employers to the extent that you will usually find them in charge of the various plants.

The operator in charge of a large power plant, especially those located away from the direct supervision of the office, in addition to being qualified in an engineering way, must be versatile, tactful, courageous, somewhat of a physiognomist, and, above all, square with his employers and the men under him. Versatile, because he often has to be a farmer, accountant, landscape gardener, sanitary engineer, and what not.

Tactful in his dealings with the public, and in presiding, so to speak, over the power plant camp, if he happens to be located in the mountains.

Courageous, because it takes courage to keep out of the "let-well-enough-alone" rut and make changes from time to time that it would be far easier to let slide, but when made would make for better efficiency.

A physiognomist, to be able to read men's characteristics, thereby determining their value as employees.

And square with his superiors and those under him because, if for no better reason, it does not pay to be otherwise.

A real operator's job is a man's job, while a near operator is a joke, and, after all,

The man who wins is an average man,
Not built on any peculiar plan—
Nor blessed with any peculiar luck;
Just steady and earnest and full of pluck.

When asked a question, he does not guess;
He knows and answers "No" or "Yes";
When set a task the rest can't do,
He buckles down 'til he's put it through.

Three things he's learned—That the one who tries
Finds favor in his employer's eyes;
That it pays to know more than one thing well;
That it does not pay all he knows to tell.

So he works and waits, till, one fine day,
There's a better job with bigger pay;
And the men who shirked when'er they could
Are bossed by the man whose work made good.

For the man who wins is the man who works,
Who neither labor nor trouble shirks;
Who uses his hands, his head, his eyes—
The man who wins is the man who tries.

In closing I wish to sound a note of warning to the men who are now in charge of the various plants. There is an efficiency wave sweeping over the country into which a number of wideawake men have plunged, clinging to the term efficiency engineer. It has already swept over the large shops of the country, the

large steam electric power plants, and its now even sweeping over the affairs of a large municipality.

While the life buoy, "efficiency engineer," has borne many wideawake men on the crest to large positions, still a far greater number of shop superintendents and engineers have been washed over, and when the wave has passed on, most of the old-established landmarks, of their jobs, have disappeared and new landmarks established, reducing the size of their jobs.

From the distance I seem to see the wave advancing towards the hydroelectric plants, and woe to the man who does not prepare a satisfactory life buoy, in the shape of an efficiently operated plant, that he may carry with him the present size of his job, and wise, I say, is the man who has built his life buoy so strong that he is able, not only to keep safe the present size of his job, but is able to rescue and keep safe bits of other jobs that has been let go by others less fortunate in forethought, thus increasing the size of his job.

A CURE FOR BOILER TROUBLES.

A paper on methods of preventing boiler scale and corrosion was presented at a meeting of the American Society of Mechanical Engineers at San Francisco on December 8, 1914, by Mr. A. H. Babcock, consulting electrical engineer for the Southern Pacific Company. This paper will be published in full in an early Journal of the Society, but its salient features are of immediate interest.

After telling of the troubles with tube replacement in the Fruitvale power plant of the Southern Pacific Company and of the fruitless efforts to overcome them, Mr. Babcock told how Mr. A. M. Hunt of San Francisco had called his attention to a report by Lieutenant Commander Frank Lyon, U. S. N., in the Journal of the American Society of Naval Engineers for August, 1912. The difficulties which had been solved by the navy were so similar to his own troubles and the method of solution so simple, that Mr. Babcock immediately applied them, and since March, 1914, boiler corrosion has been practically eliminated in the Fruitvale power station, as well as in the company's pumping plants in the California oil fields and the locomotives over the Tehachapi Pass.

The secret lies not so much in the compound used as in the method of using it. The compound is purchased in accordance with the United States Navy Specification 13C3a and consists of

anhydrous sodium carbonate.	76% (Na_2CO_3)
tri-sodium phosphate	10% ($\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$)
starch	1%
tannic acid	2%
water and impurities	10%

This compound is dissolved in hot water and added to the boiler feed water in such quantity as to always maintain a concentration of 3 per cent normal alkaline strength. This necessitates individual treatment and a close study of each boiler, as pitting will result if this standard is not maintained.

Mr. Babcock's paper was essentially a corroboration of Mr. Lyon's conclusions. The first hint of a means of remedying the trouble came from the insistence of a nurse that several spoonfuls of soda be put

in water in order to prevent corrosion or tarnishing of the doctor's instruments.

A series of tests was conducted for three years at the Naval Engineering Experiment Station in studying the trouble. As a result of this investigation, Mr. Lyon came to the conclusion that "any boiler using any water can be kept from corroding any length of time if treated with soda, and if its concentration is maintained at or above 3 per cent normal alkaline strength."

"There can be no rule-of-thumb methods of pounds of soda per i.h.p. per pound of coal burned or per gallon of feed water. The water in the boiler must be kept at, or above, a certain concentration of alkalinity, and that can only be determined from the water that is in the boiler. Each boiler must be considered as a separate unit.

"With pure feed water, sodium carbonate and disodium phosphates properly proportioned, will stop corrosion and priming if enough of the mixture is used. If impure water is used, then sodium carbonate, disodium phosphate and cutch (containing tannic acid) will, when used in right amounts, stop corrosion, prevent priming, and also prevent scale from forming, unless the saturation of sludge gets too high. Such a mixture is the Navy Standard Boiler Compound, and if the water in the boiler is, by the use of this compound, always kept at a concentration of or above 3 per cent normal alkaline strength, no corrosion will take place, no scale will form and the water will be no more likely to prime than it would be if it were untreated.

"This is a powdered compound, composed of calcined sodium carbonate, trisodium phosphate, dextrine or starch, and a tannin compound, as mangrove bark, cutch or catechu. These ingredients are intimately mixed by thorough digestion, dried, finely powdered, well mixed, and readily soluble in water."

In practice, 50 c.c. of a sample of boiler water is neutralized by a measured quantity of one-tenth normal sulphuric acid, methyl orange and phenolphthalein being used as an indicator. The amount of acid used shows the per cent alkalinity of the boiler water.

For example, if 4 c.c. of tenth normal acid solution is necessary to neutralize the alkali contained in 50 c.c. of boiler water, the percentage of the normal alkaline strength of the sample is

$$\frac{4}{50} \times \frac{1}{10} = \frac{4}{500} \text{ or } .008;$$

the sample being eight-tenths of 1 per cent of normal alkaline strength.

To be safely non-corrosive the boiler water must be at least 3 per cent of normal alkaline strength. Hence (in accordance with the general formula

$$\frac{A}{S} \times P = X,$$

when A is the number of c.c. of acid required to exactly neutralize the alkali in the sample, S the number of c.c. of the original sample, and P the percentage of normal strength of the acid used), if less than 15 c.c. of tenth normal acid is required to neutralize the 50 c.c. sample of boiler water the latter is not safely non-

corrosive, and additional compound is required in the boiler.

A standard outfit of burettes, graduates, pipettes and solutions is furnished by the navy for the use of its engineers. A similar outfit is used by the Southern Pacific Company, though any chemist can supply the necessary apparatus and directions for testing the water.

The main feature to be remembered is that the water should be tested every day and sufficient compound should be added to make up any deficiency in alkalinity. If it were not for the fact that some soda may be taken over with the steam if the boiler primes or that it is removed when the boiler is blown out or leaks, it would not be necessary to add more compound if pure feed water is used and the water level is kept constant. Some soda may be lost by combination with some of the impurities which come in with the feed water.

At the Fruitvale plant it is usually necessary to add from 4 to 20 lbs. of compound to each boiler during a watch. During 1912 there were 690 tubes replaced, during 1913 there were 858, and during January and February, 1914, tubes were being replaced at the rate of 1400 a year. The new method was first used in March, 1914, when 26 tubes were removed, in April 15, in May 2 and since then none. The treatment costs less than \$100 a month, as compared to former costs of over \$10,000 a year.

Besides preventing pitting, due to the presence of sodium carbonates, this compound also prevents the formation of scale, as the solid particles are kept in suspension until such time as the boiler may be blown out. This is due to the fact that the tannic acid prevents the crystallization, as all salts are precipitated in colloidal form. Priming is minimized by the trisodium phosphate. Frequent washing out is course necessary to remove solid matter. When the compound is first used it brings out the rust and may thus start leaks.

In the case of the Southern Pacific Company's locomotives over the Tehachapi Pass, the compound is generally added in the proportion of 3 lb. of compound per thousand gallons of feed water. A concentrated solution is introduced through the injector. The boilers are washed every second trip to remove the solid matter in the form of a soft brown mud. In the oil fields it is not possible to maintain a concentration of 3 per cent because of priming, although the corrosion has been stopped with boiler water averaging .5 per cent alkalinity.

Electrolytic iron is produced by the use of a revolving cathode in a neutral solution of iron salts. The solution is kept neutral by constant circulation about the anode. The cathode is depolarized by adding oxide of iron so as to remove the hydrogen, this permitting the use of a current of as high density as 1000 amp. per square meter. The iron salts are made from pig iron. The exceptional purity of the iron thus produced makes it of particular value for electrical machinery. Le Fer Company of Grenoble makes four tons of iron per kilowatt-year with a density of 500 amp. per square meter.

PANAMA CANAL POWER SUPPLY.

In any extended electric power project, there are always four distinct yet interrelated divisions, namely: (1) generating stations; (2) transmission lines; (3) substations; and (4) distributing network.

In connection with the Panama Canal, the main generating station is a hydraulic plant of 6000 kw. capacity, recently completed and now carrying load. The hydroelectric station is adjacent to the Gatun spillway, and receives its energy from water taken from Gatun Lake and discharged into the lower spillway channel. The electrical energy is 3-phase, generated at 25 cycles and 2200 volts (delta).

The hydroelectric station lies three-fourths of a mile west of Gatun Locks, in about the center of Gatun Dam. The permanent towns, plants, operating points, and administrative headquarters are all on the east side of the canal, which is the logical location of the transmission line. It is quite undesirable to cross the canal with a high voltage overhead transmission line; hence, the first link in the transmission system consists of a duplicate set of 2200-volt feeders, which are run in duplicate duct lines from the hydroelectric station, across Gatun Dam, and under Gatun Locks in tunnels, to the first step-up substation on the east side of Gatun Locks at the upper level.

The function of the Gatun substation is to transform the electrical energy received at 2200 volts to energy at 44,000 volts, at which potential it is transmitted by a 47-mile duplicate transmission line to three other large substations and to two small substations. The transmission line parallels the right-of-way of the Panama Railroad.

One of the large substations is at Miraflores, 37 miles distant from Gatun. Miraflores substation possesses a double function; first, to step-down the electrical energy from 44,000 volts to a usable pressure of 2200 volts for local distribution to the Miraflores and Pedro Miguel locks; and second, to serve as the interconnecting link between the entire transmission system and a 6000 kw. reserve steam generating station at Miraflores.

The Miraflores steam station is separated from the substation by less than 100 ft., and will be used in event either of failure of the hydroelectric station, or of a heavy draft of water from Gatun Lake in an extraordinary dry season. At such times the normal step-down transformation at Miraflores substation is reversed, and the substation becomes a step-up plant. During the period of Panama Canal construction, the Miraflores steam station has been operated to furnish power to the Pacific locks, and to the plant at Balboa, Ancon, and Panama.—The Canal Record.

Synthetic rubber is made by the action of chlorine and sodium on amyl alcohol (fusel oil) which is derived from potato starch. Isoprene is first produced by the action of chlorine on the alcohol, and it, in turn, is transformed into rubber by the catalytic action of sodium.

INDUSTRIAL USES OF FUEL OIL

BY F. B. DUNN.

(Continued.)

Heaters.

The object in atomizing the oil is to break it up into minute particles, and thus expose the maximum surface to contact with the air. This is accomplished in the burner, but to make the operation efficient, the oil must first be heated. A further advantage of heating the oil lies in the fact that oil will burn more quickly at a high temperature, because the hydrocarbons are more readily separated. With the ato-

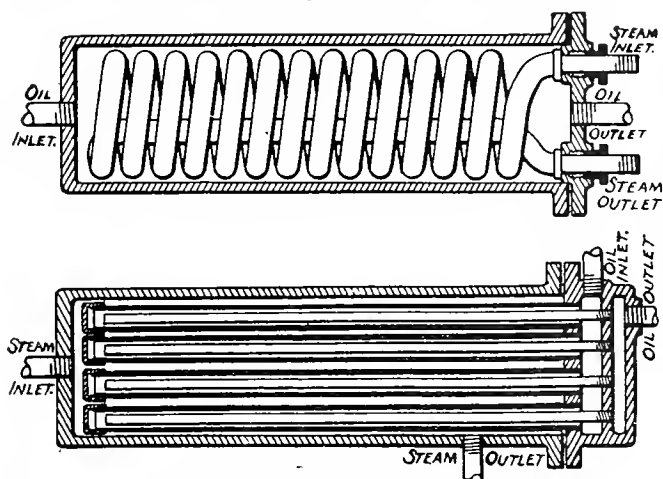


Fig. 41. Condensing Type of Heater, Showing Detail of Coil.

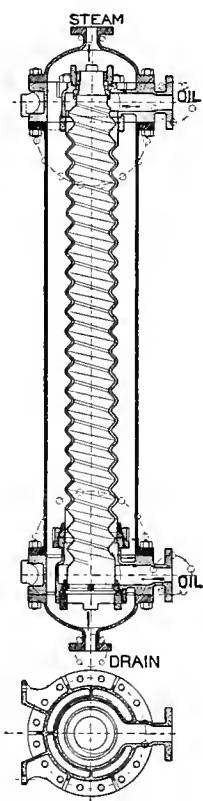


Fig. 42. Corrugated Metal Type of Heater

mizing type of oil burner, the oil is heated to a temperature of about 125 degrees F. In the mechanical type, the temperature varies from 150 degrees to 220 degrees F.

A few of the many types of oil heaters in use, are illustrated herewith. The upper part of Fig. 41

shows a copper coil through which steam is circulated; the coil is submerged in a vessel through which the oil is pumped. The large heating surface of such a coil makes it an efficient type of heater. The lower part of Fig. 41 shows the condensing type of oil heater. The oil passes through the oil inlet into a $\frac{1}{4}$ in. pipe, which is enclosed by a $\frac{3}{4}$ in. pipe. Upon reaching the end of the inner pipe it passes into and returns through the annular space between the inner and outer pipes to the discharge chamber. Steam fills the body of the heater and an outlet for the condensed water is placed at the bottom.

Fig. 42 illustrates a corrugated type of oil heater, in which the oil passes through the corrugated inner chamber and is heated by the steam that passes into the body of the heater. Fig. 43 illustrates a multiunit oil heater, constructed of extra heavy wrought iron pipe. The oil passes through the inner pipe and is heated by the steam in the annular space between the two pipes. It will be noticed that all joints are made up on the outside. The return bends are extra heavy brass castings for the oil pipes and standard high pressure ammonia fittings for the steam connections. This type of heater can be made of as many units as may be required, and can be connected in duplicate so that either heater can be cut in or out, as desired.

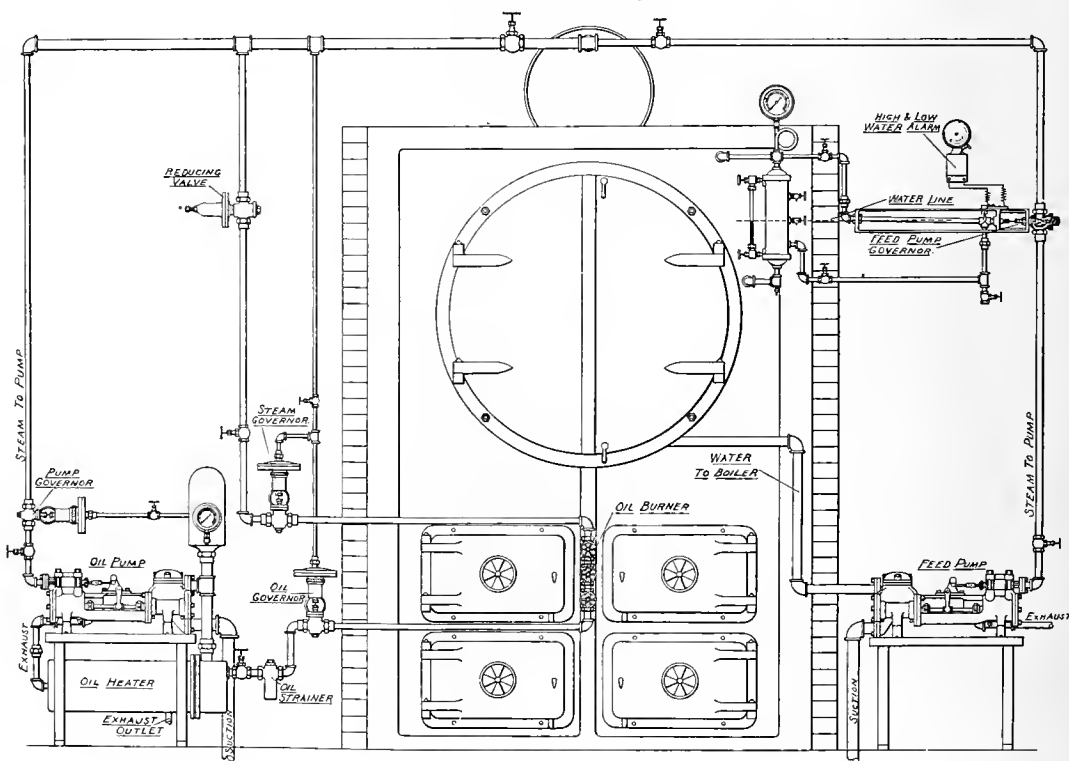


Fig. 45. Witt Automatic Regulator.

Regulators.

Figs. 44 and 45 illustrates the method of applying automatic regulators, to an oil burning system. The pressure of the steam is regulated by means of a governor that determines the amount of oil and steam fed to the burner. The operation is positive and sim-

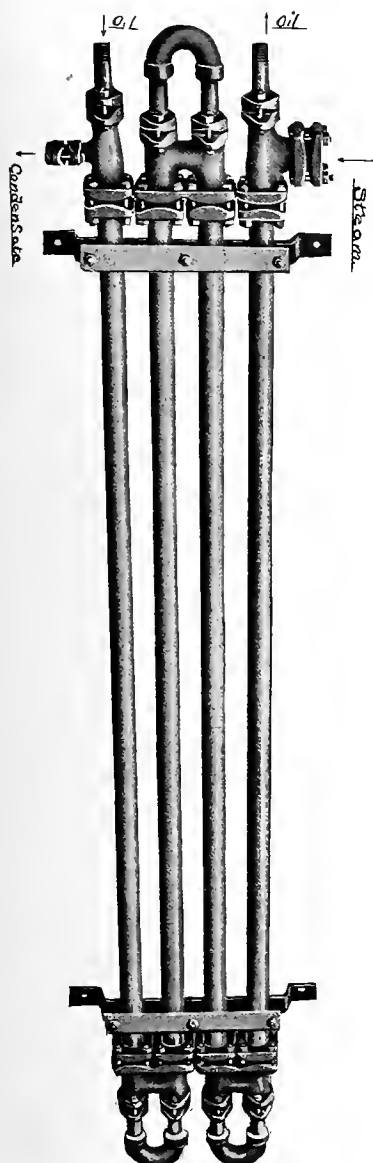


Fig. 43. Coen Multi-unit Annular Heater

ple. The regulator is set at the desired pressure and connected to the steam line from the boiler; a rise or fall in the steam pressure moves the diaphragm of the regulator, causing the spindle to open or close a valve, and thus regulating the supply of oil or steam to the burner.

There are many types of regulators on the market. Some control the steam and oil supply, while others regulate the steam and oil, and also the air for combustion. Attempts have been made to regulate the burning of oil by means of thermostats, placed either on the burner or stack. The former type has never proved satisfactory, and the latter requires constant attention, as it gets out of order due to smoke.

(To be continued.)

The efficiency of water wheels, which are new and clean, has been found to be nearly, if not quite, 85 per cent as a maximum, and is quite certain to be 83 or 84 per cent. Wheels are generally so made that the maximum efficiency is at 70 to 85 per cent gate opening on account of the probability that the gate

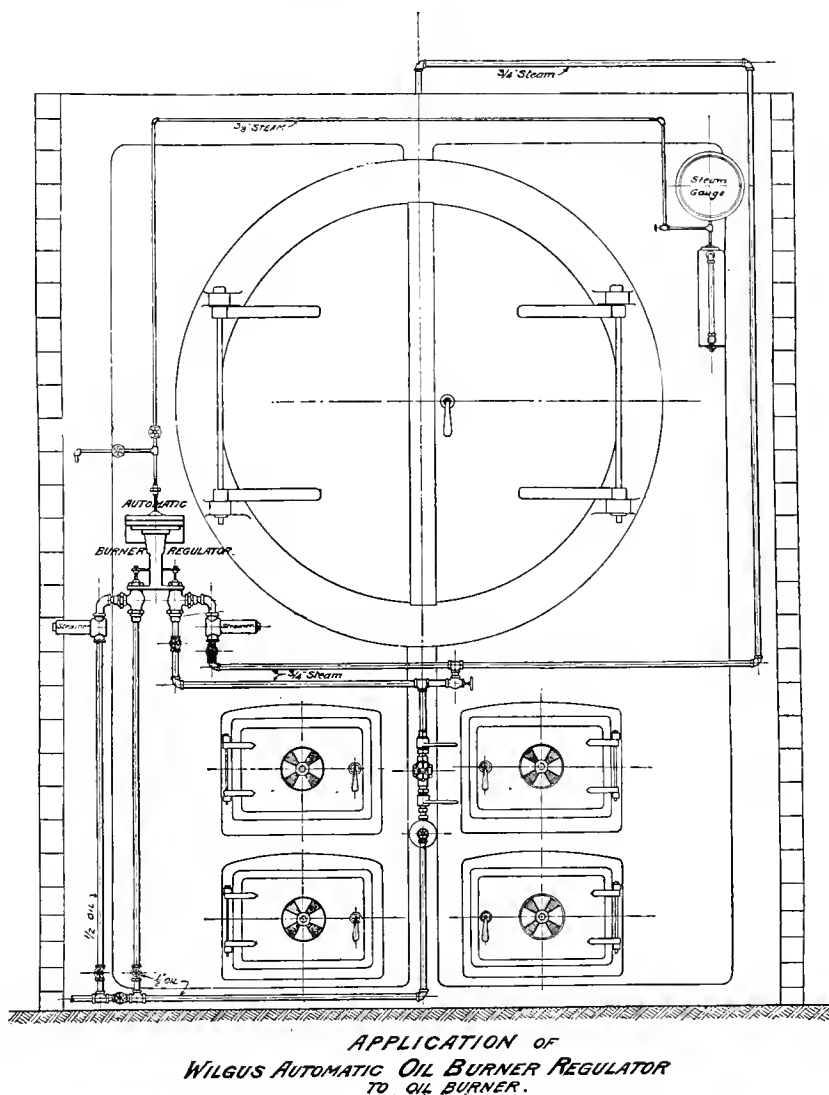


Fig. 44. Wilgus Automatic Regulator.

will not be wide open as a general thing. In practice it is impossible to keep wheels clean. They become rusty, coated with dirt, and more or less clogged with debris. As the supply of water in most cases is variable and small at times, the usual position of the gates is likely to be at such a point that the average efficiency will not be over 75 per cent. The gate opening which corresponds to this efficiency is from 45 per cent to 55 per cent.—F. W. Dean.

Efficiency, to the engineer, means the ratio of the useful result produced to the effort utilized in producing it. To the public in general it simply means doing things better. Inasmuch as the object of increasing the efficiency of an industrial operation is to reduce the cost of that operation, the only real measure of the efficiency with which the operation has been performed is found in the effect on its cost. The essential elements of a reliable cost system are a knowledge each day of (a) what was done the day before, (b) who did it, and (c) what was paid for it. The only sure way of knowing whether these returns are correct is to know beforehand (a) what should be done the next day, (b) who should do it, and (c) what should be paid for it.—H. L. Gantt.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION CONVENTION.

On Tuesday afternoon 50 members of this organization and their guests left Portland in a private car for Albany, Oregon, where they arrived at 5:30 p. m. Immediately upon arrival this delegation together with others from various portions of the state sat down to a fine dinner in the main dining room of the Albany Hotel. This dinner was presided over by Mr. J. F. Werlein of the Portland Railway, Light & Power Company. This meal was interspersed by "stories" and the "joshing" of the various members.

Following the dinner a "bowling contest" took place between the jobbers and contractors in which the contractors were easy victors.

On Wednesday morning the meeting was called to order by R. G. Littler, president, in the Convention Hall of the Hotel Albany. Mr. Werlein made a few remarks regarding electricity in which he said in part: "It is the one element we receive from above and it signifies purity in its true sense. The ease with which electricity can be handled, although it can become the most destructive force known, convinces me that this same destroyer of life, will be the source of eternal life for man. Your president, Mr. Littler, appeals to me through his quiet unassuming manner and the results he has attained as president of this organization stand as a monument to his ability."

The president then read letters from Messrs. John R. Galloway, president, and Geo. Duffield, secretary of the National Electrical Contractors' Association, wishing the Oregon organization a successful convention.

Mayor L. M. Curl, of Albany was introduced and gave a short address of welcome, in which he said that he felt that the O. E. C. A. would be a pertinent factor in the development of the state. Also he appreciated the fact that the convention had come to Albany, as they were proud of their city and desired to show it off, and he desired to extend a standing invitation to the association to come again any time they saw fit and stay as long as they desired. President Littler responded to the mayor's hearty welcome in a few well chosen words, expressing every one's feelings that Albany had been a most genial host.

J. L. White, local manager of the Oregon Power Company, Albany, then read his paper on "The Relation of the Contractor and Dealer to the Central Station," as appears on page 552.

This paper was discussed by Messrs. F. C. Green, R. G. Littler and A. C. McMicken, who brought out the fact no purely electrical store had been able to merchandise electrical goods unless they were connected with a central station. The idea of an electrical store was admitted as correct but the central stations desire to be "shown," before they are willing to turn the business over to independent effort. Mr. Tomlinson said he visited the New York Edison Company's New York store last year and they were only carrying samples and turned the orders over to dealers and contractors but it was not satisfactory.

Mr. Hill said he had been a contractor and could appreciate the views of contractors. When the time comes that the various devices can be placed in the hands of the consumer by an independent dealer, he said the central stations would be glad to give up merchandising. He thought, personally, that a great deal of education was needed by the public along these lines and that personal solicitation from house to house was the only way to procure results. The Los Angeles Edison Company, is using this method now. Not all the houses at the present day are wired and that also handicaps the sale of electrical appliances. Closer relations should be maintained between the central stations and the contractors. In Portland, as in many other cities, central station competition caused the central stations to stay in the business. He suggested that the contractors furnish

the central stations with a printed card giving the names of all reputable contractors, so that the solicitors for light and power could give them to owners who desired work done. This method would relieve the power company of recommending any specific person, which, of course, is seldom allowed by any central station.

Mr. McMicken brought up the subject of complaints of customers which were due to poor work of some electrical contractor and said that generally the central station got the blame, and he thought that some way should be devised to relieve this situation.

M. J. Walsh said all he wanted was a chance to show the central stations what could be done in electrical merchandizing. Mr. Skeen desired to say that central stations had done more in the past for contractors than they had done for themselves.

P. A. Young then presented a paper on "Credits and Collections." Mr. Young's paper brought out the following points:

- (1) All problems divisible into parts which parts are of easy solution.
- (2) The sale of goods is easy, but true ability is shown by collecting the money after the sales.
- (3) Credits are influenced by (a) Local Conditions; (b) Investigation of person desiring credit; (c) Amount of capital a firm desires to invest.
- (4) Credit men to be successful must have good "horse sense."
- (5) Many times merchandising companies find themselves doing a "banking business" in their credit system.
- (6) The whole system of credits can be summarized as "Common sense classified."

Mr. Tomlinson said that the contractors had one kind of business, that the determining of credits was very difficult, for instance, orders for repair work received over the telephone. Mr. Werlein thought the spirit of "get-the-money" was wrong, that the contractors should use diplomacy. M. J. Walsh said that his company was getting references before allowing credit. Mr. Young said he thought an error was made many times in not sending out a "high" enough class man to make collections. Mr. Poppleton advised the use of the State Lien Law, for collection purposes. Mr. Holkenbrink raised the question whether power wiring could be "lien" against the owner of a building if the tenant was irresponsible. Same question regarding light wiring. Mr. Oberender stated that the lien laws of Oregon were deficient and he was of the opinion that the "power" wiring could not be made a "lien" against the owner, as it was a "fixture" of the tenant but that "light" wiring could be.

President Littler appointed committees on Resolutions, Nominations, and Membership.

Mr. Weber gave a short talk covering the Underwriters' desire to maintain a high standard of efficiency in electrical construction and desired to see the O. E. C. A. succeed.

Mr. John F. Ryan presented a paper on "The Jobber and the Contractor," as appears on page 553.

Messrs. Green, Skeen, Schrof and Hill discussed this paper. Mr. Hill said he thought the contractors' association should guarantee its members. Mr. Ryan thought that the consumer is given contractors' prices sometimes, which is not the desire of the jobber, this results from carelessness on the jobbers' part, also the practice for years has been to consider "isolated plants" entitled to contractors' discounts.

Mr. McMicken of the Portland Railway, Light & Power Company made a short address in which he brought out the following points. In his experience of 12 years in the electrical work in Portland, he noted a wonderful improvement in the contracting business. This progress has been due to individual effort, but more to the co-operative efforts of all those interested in the business, and it is too bad so many failures have taken place in the past, and that the O. E. C. A.

had not been organized many years ago to educate contractors along business lines. He urged the adoption of a code of ethics by the association which would, if adhered to by all the members, automatically attract business to them.

Mr. Caulfield suggested sending a delegate to the Commonwealth Conference held in Eugene to suggest a change in the present lien laws of the state.

In the afternoon a party was taken through the substation and filtration plant of the Oregon Power Company. The filtration plant has a high efficiency, water being received with 7000 bacteria to the cubic centimeter and after filtration it contains 72. The best well water contains 50 to 70 bacteria to the cubic centimeter.

At 2 p. m. there was a business meeting of the association at which time a consolidation of the "Portland" and "Oregon" Electrical Contractors' Associations was made into the Oregon Electrical Contractors' Association. A delegate was appointed to attend the Commonwealth Conference in Eugene to urge change in the lien laws: An effort through the legislative committee of the association to get the proper legislation at the coming session so that the contractors for electrical wiring and equipment be let separately and not included in a lump contract for the building. At present Pennsylvania has such a law. The following officers were elected for the ensuing year:

John Tomlinson of Portland, was elected president of the association for the ensuing year and other officers were named as follows: First Vice-president, Harry Sroufe of Portland; Second Vice-President, Joseph H. Ralston of Albany; Third Vice-President, Lester Armitage of Corvallis; Secretary-Treasurer, J. W. Oberender of Portland. To serve with these officers on the executive committee, S. C. Jaggard and F. K. Green, both of Portland, were chosen.

Those registering at the convention were as follows:

W. H. S. Hill and wife, Northwestern Electric, Portland, Ore.
 Geo. A. Boring, Pacific States Electric Co., Portland, Ore.
 F. C. Todd, Pacific States Electric Co., Portland, Ore.
 Owen Osborne, Portland Railway L. & P. Co., Portland, Ore.
 J. E. Werlien, Portland Railway L. & P. Co., Portland, Ore.
 A. M. Sherwood, General Electric Co.
 F. O. Broili and wife, Northwestern Electric Co., Portland, Ore.
 L. B. Zigwart, Hunter Electric Co., Eugene, Ore.
 F. C. Green, E. L. Knight & Co.
 G. A. Kumbler, Pacific States Electric Co.
 A. M. Sherwood, Jr.
 M. J. Walsh, M. J. Walsh & Co., Portland, Ore.
 Basil Witzig, General Electric Co., Portland, Ore.
 J. H. Ralston, Ralston Electric Supply Co., Albany, Ore.
 R. R. Poppleton, Rep. Crocker-Wheeler Co., Portland, Ore.
 R. C. Littler, West Coast Engineering Co., Portland, Ore.
 J. R. Tomlinson, Pierce-Tomlinson Co., Portland, Ore.
 P. A. Young, Albany, Ore.
 L. M. Curl, Mayor of Albany.
 C. P. Osborne, Portland, Ore.
 E. H. LeTourneau, Portland Railway L. & P. Co.
 F. D. Weber, Underwriters Eq. Ra. Bu., Portland, Ore.
 H. F. Holkenbrink, Portland Electric Maintenance Co.
 F. Cole, Armitage & Co., Corvallis, Ore.
 W. H. Smith, W. H. Smith Electric Eng. Co., Portland, Ore.
 E. W. Pierce, Pierce-Tomlinson Co., Portland, Ore.
 A. C. McMicken, Portland Railway L. & P. Co.
 J. B. Hope, Hope Electric Co., Lebanon, Ore.
 O. B. Penrose, Fobes Electric Supply Co., Portland, Ore.
 E. L. Knight, E. L. Knight & Co., Portland, Ore.
 C. C. Crawford, Portland Railway L. & P. Co.
 T. F. Pierce, Rep. M. J. Walsh of Peerless Lamp Wks., Portland.
 O. B. Helt, General Electric Co.
 J. A. Ryan, Western Electric Co., Portland, Ore.
 F. E. Davis, Western Electric Co., Portland, Ore.
 W. E. Flack, Marshall-Wells Hardware Co., Portland, Ore.
 A. J. Cogley, Telephone Electric Eq. Co., Portland, Ore.
 G. L. Priest, Jobber, Portland, Ore.
 S. C. Jaggard, Morrison Electric Co., Portland, Ore.
 C. R. Dederick, Fobes Electric Supply Co., Portland, Ore.
 R. W. Stubbs, A. B. Stubbs Electric Co., Portland, Ore.
 B. E. Lucas, A. B. Stubbs Electric Co., Portland, Ore.
 Carl F. Caulfield, Labor Commissioner, Portland, Ore.
 Mrs. D. B. Sherve, Stayton Electric Co., Stayton, Ore.
 E. J. Borcourt, Borcourt Electric Co., Portland, Ore.
 H. H. Burgy, Burgy Electric Co., Portland, Ore.
 S. W. Peterson, Rep. Cutler-Hammer Co., Portland, Ore.
 W. O. Fouch, Western Electric Works, Portland, Ore.
 A. N. Derby, John A. Robeling Sons Co., Portland, Ore.
 J. H. Sroufe, NePage-McKenney & Co., Portland and Seattle.
 Robert Skeen and wife, Skeen Electric Co., Portland, Ore.
 R. F. Walton, Newton Electric Supply Co., Albany, Ore.
 F. E. Myers, H. M. H. Electric Co., Portland, Ore.
 A. S. Halls, Pacific Fire Extinguisher Co., Portland, Ore.
 J. W. Oberender, Secretary of O. E. C. A.
 H. W. Scott, Scott Electric Co., Astoria, Ore.
 S. C. Luckey, Astoria, Ore.

THE RELATION OF THE ELECTRICAL CONTRACTOR TO THE CENTRAL STATION.

BY J. L. WHITE.

In preparing this paper I realized that the subject is one that has been under discussion time and again. Nevertheless I feel that it is one of great interest and I hope that the points which I will endeavor to bring out will promote some serious discussion.

As it is today, in a great many instances, the words contractor and dealer mean practically the same thing. The majority of contractors are dealers, to a certain extent. So in speaking on the above subject I include the dealer in the same class with the contractor.

It is a little embarrassing to talk on the subject of the relations of the contractor to the central station, for it would seem that the interests of both are so interwoven as to permit of little discussion. Surely the central station is interested in the success of the contractor, and therefore a condition exists that practically demands they should work together.

The story of the central station is a history of electric lighting in this country, together with the enormous kindred business interests which have been created as a result of these operations.

The electrical contractor was not a factor in the early period of the business because his work as a business did not exist. The companies were the entire electrical industry within themselves, for they erected and operated the lighting plant, constructed their lines and finally installed the wiring on the premises.

After a time, the great expansion and the consequent necessity for greater economies suggested a separation of the inside construction, or wiring end of the business, from the other operations of the plant, and brought the electric wireman or contractor before the public in the industrial life of the community.

This expansion brought about a number of other subdivisions in the field; notably the manufacturer, the jobber and the consulting engineer. The contractor is the only one of the units that is brought in direct contact with each of the others, as well as, in the opinion of the central station, the most important of all, the customer. Every possible effort must be made on the part of the contractor to secure and retain the good feeling of the customer. He should have the highest aims for the conduct of his business, treating his customers fairly, as well as keeping in mind constantly that the class of work that he does should be of such an order that it will always stand to his credit in the future. The representatives of the lighting company know only too well that the contractors do their utmost to secure service for them and I think that the central stations should always be willing to place at the disposal of the contractor their engineering data and also their engineers if necessary.

As I have already stated, the business of the contractor in the earlier stages of the industry consisted of wiring installations and the furnishing of such inexpensive lighting fixtures as were necessary at that time. Heating devices and the various other appliances that we have today were then unknown. I believe the time is fast coming when the retail business will be taken care of by an electrical dealer operating a neat, well appointed store in which he makes suitable displays and demonstrations in the various lines of electrical devices and apparatus as appeal to the shopping trade. He will do practically no contracting but will confine himself strictly to retailing. He will leave the installation end of the business to the general contractor who will conduct his business from an office building. These conditions of course will only obtain in cities of the larger size. In many smaller places where the contractor is compelled to

carry on a merchandizing business we find most complete lines and these stores compare favorably with the best stores in other lines in our cities.

In the very nature of things there should exist a co-operative relationship between the contractor and the central station, and these two words sum up the situation. There is unquestionably a mutuality of interests between the two. It is true that this co-operative tie that binds the business of the contractor and the central station has not as yet been pulled taut. But the trend is in the right direction and while ideal conditions in every instance are not yet obtained, there can and should be closer and more friendly relationship. A closer co-operation between the central station and the contractor is sure to benefit both.

The smaller contractor in the less prosperous neighborhoods is chiefly engaged in small installations in cheap dwellings. If the central station will help this class of contractors by referring wiring prospects to them they in turn are, I am sure, ready to reciprocate. It is this kind of team play and good feeling that should be cultivated.

To my mind the one obstacle that has blocked the way to the contractor's success and for that reason has a bearing in this paper, is the competition from the central stations, due to the giving away of current consuming devices or selling them below cost. This is an age of specialization and I think that the central station should be solely the supplier of energy. Electric wiring and contracting is also a business in itself and I do not believe that the average central station can handle wiring contracts or sell appliances as satisfactorily as a contractor. The general public is skeptical about any article the central station may sell, fearing that such contrivances will use the maximum amount of energy and not the minimum. The majority of people cannot see why the central station should want to recommend devices which use the least amount of energy when it is its business to sell energy.

Another feature in a plan of co-operation between the contractor and central station is in the matter of each endeavoring to adjust the complaints made against the other. It frequently happens that the contractor or the company is in a position to satisfactorily adjust a complaint or remove the antipathy arising from some real or imaginary grievance.

There are many reasons for the greatest of co-operation between the contractor and the central station and the one thing that will accomplish the most satisfactory results is confidence. Confidence is the keynote of any attempt to raise the standards of the electrical industry. Confidence comes with an understanding of what the other fellow is doing.

Recognizing the pulling power and the force of combined effort toward a common end there have been many efforts made to unite the several lines of electrical interest on common ground. The Society for Electrical Development is one of the more recent and important of these combinations. I am entirely aware in suggesting this thought that many harmonious plans are being devised and even carried out. Contractors and central stations in many communities are working in complete harmony, with good results to both.

As to the part that the central station should play in this co-operative relationship, I suggest, first, a trained sales force co-operating with the contractor in stimulating demand for energy-utilizing devices; second, no direct sales by the service company; third, frequent conferences with the contractor as to new possibilities which are always arising for extension of the use of energy. By this method misunderstanding will be minimized and results in profits to contractor and lighting company and satisfaction in service on part of the public will be augmented.

HOW CAN THE ELECTRICAL CONTRACTOR BENEFIT HIMSELF AND THE ELECTRICAL BUSINESS AS A WHOLE FROM THE STANDPOINT OF A JOBBER.

BY JOHN F. RYAN.

The subject assigned to me is one of such vast importance that it has been given a great deal of thought and consideration by the electrical jobbers and one which is of vital interest to not only the contractor himself but to all the other branches of this great and rapidly developing electrical industry.

The contractor is rapidly developing into the medium and to a great extent has been recognized as the proper channel through which the central station, the jobber and the manufacturer is to reach the ultimate consumer. He is also to be recognized as the most important factor and must be looked to for the maintenance of the standard of quality as set forth by the National Board of Fire Underwriters, which board has been one of very great importance toward the development of safe and sane current consuming devices and one of the main factors in developing the electrical contracting business from that of a boy's task to the important position which it now holds in the progress of electrical development. With these facts brought so forcibly to our attention the success of the contractor, as well as all the other branches of the industry, resolves itself into the simple answer of co-operation. By co-operation I do not mean the banding together of the electrical contractor for the purpose of regulating or controlling prices, nor is it intended for the purpose of forcing his weaker brother, who is not a member of his association to discontinue business. This is not co-operation in its true sense.

By co-operation I mean that it is the duty of every electrical contractor to co-operate with his fellow contractors by becoming a member of any organization whose object is the up-lifting and development of his particular line of business. There are of course a great number of contractors who at the present time can not realize the benefits to be derived from such a co-operative movement. It then becomes the duty of the broad minded co-operative contractor to try and persuade his smaller and narrower minded fellow worker to become a member of his association that he may also share the benefits to be derived from such co-operation.

It must be remembered, there is still much good standing timber which is absolutely necessary for the proper construction of your association and before your task is completed this timber must be utilized. On the other hand, there are a number of so-called contractors, who cannot see beyond the sphere of their own little business and who never can be educated to co-operate with their fellow contractors. This type of contractor is not only a detriment to the contracting business but to the electrical industry as a whole. He is generally a man who knows nothing about his overhead or cost of doing business. He takes his contract at such a low margin of profit that he must purchase the cheapest class of material. He is forced to do cheap work, with the result that he becomes a thorn in the side of the legitimate contractor who tries to do good work. The central station must stand the brunt of his poor work and he is a source of continual trouble to the National Board of Fire Underwriters. This contractor continues along these lines until such time as he becomes so heavily involved that his career as a contractor soon spells failure, with the result that the jobber must carry the burden of his failure. This contractor should be shunned by all branches of the electrical business as his work is destructive rather than constructive.

With the electrical contractors organized in such an organization, they should educate their members for the economical handling of their business by the interchange

of experiences relating to their contracting problems. They should encourage their members to work in harmony with the National Board of Fire Underwriters and uplift the standard of the business by using nothing but approved quality material. They should devise ways and means for the proper distribution of their wares to the consumer by taking a personal pride in the appearance of their retail store, fixing it up in a manner to demand the respect of the retail commercial world which rightly belongs to it, thereby demonstrating to the central station, the jobber and the manufacturer that they are capable of properly handling the distribution of current consuming devices which play such an important part in the existence of the central station, thereby releasing the central station from the responsibility which they owe themselves, the jobber and the manufacturer for the placing of these current consuming devices before the ultimate consumer. They should endeavor as nearly as possible, to give their support to the electrical jobber distributing in the territory in which they are located, for without the support of the electrical contractor, the jobber is left to choose between the discontinuance of his existence as a jobber or look to other fields for the marketing of his wares. If the jobber should be forced to discontinue on account of the non-support of the electrical contractor, it would force every electrical contractor to become a jobber, forcing him to greatly increase his investment in stock, thereby increasing his overhead to such proportions as to retard the progress and development of the business and those of you, who could not for financial reasons carry the tremendous investment necessary to properly conduct the business would be forced to discontinue.

Inasmuch as the jobber is as necessary to the existence of the contractor and the central station as the contractor and the central station are to the existence of the jobber, why not let us co-operate through our different associations for the mutual benefit of the industry as a whole?

Those of you, who have been in the business for any great length of time, if you will stop and retrace a few years of your life, you will recall when the central station was not only the generating plant but also the jobber, contractor and retailer. The electrical business then was merely in its infancy. The central station considered the jobber as well as the contractor illegitimate competitors. They were never intended to be nor were they necessary for constructing the wheel of this great electrical industry but like all other commercial industries it began to expand and grow at such a rapid rate that it was soon beyond the control of the individual or central station. The jobber became a necessity, he was also recognized by the manufacturers as the best and cheapest medium through which to market their products for the reason that by incorporating under one organization the products of a great number of manufacturers, he was able to greatly reduce the cost of placing the manufacturers' products before the public.

The central station, like the manufacturer, soon began to realize the importance of the electrical jobber. It enabled them to greatly reduce their investment in stores. It enabled them to secure prompt delivery on the material which they needed. They came to be recognized as the foremost advance agents in the placing of new current consuming devices before the public and in this way the electrical jobber began to work into the good graces of the central station and is today looked upon as a very important position of their industry.

Not unlike the jobber is the electrical contractor. At first they were forced in keen competition with the central station until by concentrated effort and specializing in their particular line, they were enabled to successfully compete and prove to the central station that they were in better position to successfully serve their customer than the central station themselves. The central stations were quick to note the progress and advancement of the contractor until

today nearly all the central stations in the country have discontinued their wiring departments and concentrated their efforts in other directions.

It is with great interest that I look forward to the time—and I do not think that time is very far distant—when the electrical contractor through his co-operation with all the other branches of the electrical business will be enabled to prove to the central station, the jobber and the manufacturer, that he is the true and legitimate channel through which we are to reach the ultimate consumer by the well equipped retail electrical store.

When conditions such as these exist, the central station will become a central station in its true light; the contractor will become a contractor; the dealer will become a dealer and the electrical jobber will become an electrical jobber in every sense which the word implies.

CONSERVATION OF WESTERN WATER POWER RESOURCES.

Strong objections to the provisions of the bill passed by the house of representatives at the last session of Congress and now before the senate committee on public lands "to provide for the development of water power and the use of lands in relation thereto and other purposes" were set forth by E. A. Wedgwood of Salt Lake City in a paper on "Conservation of Western Water Power Resources," which was distributed among members and delegates to the seventeenth annual session of the American mining congress. The bill is impracticable from a business standpoint, the paper declared, and insufficient assurance of co-operation is given states and private investors by the federal government in the provisions of the bill. "Conservation of natural resources demands immediate development of available water powers. Three factors control the development of western water power resources:

"The right to the perpetual use of flowing waters;

"The right to occupy the necessary public lands for dams, power houses, water conduits and pole lines;

"Money sufficient to construct dams, water conduits, power houses and transmission lines."

By reason of the ownership of large bodies of land, valueless for other useful purposes, the paper argued, development of western states and the investment of capital is being retarded by the federal government which "apparently assumed to control water power development and therefore the progress and material welfare of these states."

"Ought the mere ownership of a few acres of desert lands give this power? All the lands in private ownership are subject to the law of eminent domain. If federal ownership does carry such power and the law of eminent domain does not apply to such lands, ought federal power over these lands to be used to retard the progress of a state and prevent the conservation of its natural resources?"

"It is believed that congress, in its wisdom, should at once provide that the respective states, through their citizens, may be on practical terms and conditions, just and fair to all interests, national, state and private, the use of the public lands to the extent necessary, whereby to wrest the power from the falling waters and thereby upbuild the state and advance the good of human kind during the present and future generations."

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Progress is prone to forget its debt to the past. Many modern methods were foreshadowed by the ancients, and their experience can be applied with benefit to present problems. Especially is this true in reclamation and irrigation of arid lands, concerning which we may learn much from the ancient Egyptians. The story is well told elsewhere in this issue by Mr. A. E. Chodzko, as applied to the use of the rice crop as a profitable by-product in neutralizing alkaline soils. The subject is one which should be of interest to every central station serving an irrigation load.

The most progressive peoples of historical times have been instrumental in developing the art of irrigation. Irrigation was practiced before the dawn of history. Whether it originated in Asia, Africa, Europe, or even America, is difficult to determine. The faint records of the early Egyptian dynasties, the monuments of Babylon and Assyria, the ruins of Persia, India and China, and the relics of the Aztecs all show that irrigation was one of the first agricultural practices of mankind.

These antiquities also prove that little progress was made in the methods of applying water to arid lands until late in the nineteenth century. It is seldom realized that Brigham Young, the founder of the Mormon colony in Utah, was really the father of modern irrigation methods. One of his first acts, after reaching the present site of Salt Lake City in 1847, was to give "the soil a good soaking of water brought from the neighboring City Creek, through a plow furrow that served as a ditch." Laws and customs in the use of water, which remain as a model to the present day, were then created.

The most notable advances in irrigation methods since then have been contributed by engineers. Successful irrigation depends upon close co-operation between the farmer and the engineer. The engineer provides the means whereby the farmer may get the results. The engineer builds the dams, canals and pumping equipment which insure an adequate and dependable supply of water. The farmer uses the water to the best advantage in producing crops. Without proper co-operation the work of neither party is of full avail.

As a new means of popular transportation the "jitney" bus, an automobile tram, has recently entered into active competition with the electric railways of the Pacific Coast, particularly in Los Angeles.

The "Jitney" Bus

These buses, many of them five-passenger cars, give frequent service at a five cent fare and are so heavily patronized as to make serious inroads in the traction company's revenue. In Los Angeles there are over a thousand men engaged in this business in addition to the regular taxicab service.

The situation is indeed strange that makes possible this competition with what is admitted to be one of the finest street railway services in the world. A justifiable excuse for their operation would exist if the transit methods were inadequate or if the charges

were exorbitant. Some are even bold enough to prophesy that this mode of transportation will eventually supersede the street car. Yet a moment's consideration will show the fallacy of this idea.

To begin with, this competition is a reflex of the hard times. Men who have nothing else to do are picking up a little money in this manner but will discontinue the service as soon as they get more remunerative employment. Consequently there is no likelihood of permanency. A heavy rain storm puts the machines out of business and the public necessarily patronizes the street cars. Service is now the great demand to be met by any public utility and is the point in which the jitney bus is weak.

Safety, also, is a modern requirement. The numerous automobile accidents testify to the need for more rigid regulation of this traffic, particularly on city streets already congested by vehicles engaged in normal pursuits.

Considering the large amounts spent by the traction companies in maintaining service and insuring safety some similar form of insurance should be required from those giving this transient transit facility. Corrective legislation is a probability of the immediate future and the "jitney" bus will pass into oblivion.

The poetic suggestion about the flowers wasting their sweetness on the desert air is called to mind by the interesting story of how a remedy was found for the ills to which the boilers in the Fruitvale power plant of the Southern Pacific Company were heir. After months of fruitless efforts in trying to stop pitting, and after thousands of dollars had been spent in tube replacement, a fortuitous discovery put an end to all the troubles. Furthermore, the find was most simple.

It seems that the same difficulties had been experienced by the U. S. Navy some years before. Wherever it was necessary to use saline waters for boiler feed purposes, a universal necessity for every navy but Switzerland's, an inexplicable and baffling corrosion of boiler tubes ensued. Lieutenant Commander Lyon, after months of painstaking research, came to the conclusion that such corrosion could be obviated by making the boiler feed water strongly alkaline. The medicine worked like a charm, and the "Oregon's" tubes were kept cleaner than the day of the trial trip.

Unfortunately the record of this worthy accomplishment was hidden away in a scientific tome and in danger of oblivion until brought to light by engineering research to find a cure for a similar disease in the Fruitvale plant. The conditions were so alike and the treatment so simple, that the navy compound was tried and has been used with marked success ever since, as is reported elsewhere in this issue.

The results of using this compound with some of the non-saline waters of the interior States would also be of interest. That this method of treatment should prove successful in all cases transcends all chemical experience. Correspondence on this subject is invited from our readers.

A unique thought is suggested in a paper presented at the December meeting of the American Society of Mechanical Engineers by Mr. Henry Bruere of New York City that engineering methods could well be applied to increasing

Police Inefficiency

the efficiency of the police department of the average American city. "Scientifically the most neglected field of public service in America is the police department." He develops the fact that it is the function of the police to protect those institutions of civilization which it has been the prime purpose of the engineering profession to establish. This has usually been done by repairing the wear and tear of social friction instead of obviating the causes of that friction.

Briefly, he proposes that the fundamental principles of efficiency be applied to police administration. Standards, records and ideals are needed. He criticizes the military type of organization which submerges the initiative of the individual and makes possible the political control of police departments. He advocates that the rewards and the discipline be more in accord with the recognized dictates of scientific management.

The scientific methods which have evolved the Bertillion and finger-print systems of identification should be applied to other police problems, such as the control of traffic. Particular attention should be paid to the compilation of records and to their analysis in order to find means of preventing crime. While it is manifest that the existing product of past mistakes cannot be corrected by eliminating the conditions which caused them and that these criminals must be dealt with through the established penal machinery, the purpose of these suggestions is to prevent future crime.

A bureau of crime prevention is equally as important as a bureau of crime detection. The lack of preventive methods constitutes the essential weakness of police protection. It is characteristic of engineers to prevent trouble by anticipating it. Certain effects are invariably the result of certain causes. It is better to remove the cause than to try to cure the effect. Such anticipation is the essence of service. Lack of it is the main reason for police inefficiency. Here is a fertile field for engineering study. Some of the methods by which the engineer controls the forces of Nature may well be applied in controlling the forces of men. These forces need diversion into proper channels rather than repression. The science of police engineering is only a special case of the general science of human engineering—scientific management.

With such glaring examples of the inefficiency of the present methods of political control of municipal activities as are known to exist, the question of applying the same methods to the control of electrical or transit facilities should also interest the public. Would it not be better to improve the present branches of the public service than to take over new branches whose success are even more vitally dependent upon efficiency? At least let us increase the efficiency of our present public servants before giving them new tasks which are now efficiently performed by private owners.

Treating Boilers

PERSONALS

Henry Guilbert, of Guilbert Bros., electrical contractors, of San Jose, Cal., was a visitor in San Francisco during the week.

Chas. Noack, manager of the Coast Valleys Gas & Electric Company, Monterey, Cal. was a visitor to San Francisco during the week.

Ross Hartley, district manager Pacific States Electric Company, Portland, Ore., spent the latter part of the week in San Francisco.

E. A. Quinn, general superintendent San Joaquin Light and Power Company, Fresno, spent several days during the week in Los Angeles, Cal.

H. C. Goldrick, representative of Kellogg Switchboard and Supply Company, San Francisco, returned after a short trip to Southern California.

J. H. Newlin, purchasing agent of the San Joaquin Light and Power Company, Fresno, Cal., spent several days during the week in San Francisco.

O. F. Hanson, representative of the National Pole Company, Seattle, Wash., spent the week in San Francisco on a business trip of the coast cities.

Geo. Campbell, manager Reno Water, Light and Power Company, Reno, Nevada, has left for a business trip to Boston, Mass., and other Eastern cities.

A. E. Wishon, manager San Joaquin Light and Power Company, Fresno, who has been recovering from illness in San Francisco, left for home during the week with Mrs. Wishon.

R. E. Koons, chief surveyor with Burns & McDonnell, hydraulic engineers of Kansas City, Mo., was a recent Seattle visitor on his way to Everett, Wash., where his firm will supervise the construction of the municipal water works.

A. C. Macbeth has been elected vice-president and general manager of the Southern California Gas Company to succeed **A. C. Balch**, who recently gave up the active management because of poor health. Mr. Balch will continue his duties as a director.

O. A. Schlessinger, representative of the United States Light and Heating Company, San Francisco, has returned after a month's trip to the factory at Niagara Falls and through the East. He reports business conditions as showing a tendency toward improvement.

Francis V. McGinness, sales engineer of the Edison Storage Battery Company, Orange, New Jersey, has been appointed assistant manager of the railway department, taking the position of William F. Bauer who was recently made manager of the company's Chicago office.

John A. Britton, vice-president and general manager of the Pacific Gas and Electric Company, is one of several representatives of Western power companies now appearing before the Public Lands Committee of the United States Senate in the hearings on the administration water power site leasing bill.

C. B. Hunt, formerly wiring-device specialist of the General Electric Company at Chicago, has been appointed Pacific Coast manager of the Robbins & Myers Company of Springfield, O., and will have charge of the company's exhibit at the Panama-Pacific International Exposition, after which he will maintain permanent offices in San Francisco.

John Tomlinson of Portland, Oregon, has been elected president of the Oregon Electrical Contractors' Association; **Harry Stroufe** of Portland being first vice-president, **Joseph H. Ralston** of Albany, second vice-president, **Lester Armistage** of Corvallis, third vice-president; **J. W. Oberender** of Portland secretary-treasurer. The other members of the executive committee are **S. C. Jagger** and **F. K. Green**, both of Portland.

MEETING NOTICES.

Los Angeles Section, A. I. E. E.

An interesting and well-attended meeting of the Los Angeles Section of the A. I. E. E. was held in the lecture hall of the Chamber of Commerce on Tuesday evening, December 8th, and was presided over by Chairman Pyle. The meeting was devoted to the reading and discussion of papers on the various types of storage batteries and their applications. The first paper was read by I. R. Solomon on the "Lead Storage Battery," and he was followed by James F. Rogan, who exploited the merits of the Edison Alkaline Storage Battery. The lively discussion which followed was opened by the reading of a paper by Harry N. Sessions and brought out many divergent views regarding the availability of storage batteries for central station service and vehicle operation, which was participated in by Messrs H. W. Harrison, R. C. Cates, H. A. Barry, F. B. Lewis, Ph. Taylor, E. R. Northmore and the chairman. These papers will be published in an early issue.

Oregon Society of Engineers.

There was a special meeting of the Oregon Society of Engineers in room B of the Public Library, last Friday evening (December 4th) to consider means for establishing a reading course for the younger engineers and in other ways enlarge the work of the library and the society. Material progress was made in getting this matter into final shape. The regular Monday luncheon club met in the Crystal dining room of the Benson Hotel, Portland, Oregon, December 7th, and listened to an address by Richard W. Montague on "Municipal Ownership and the Scientific Spirit." Mr. Montague said that he had attended the conference of municipalities in Seattle and listened to the discussion on this question and he decided "that there was more 'heat' than 'light' thrown on the subject." He said the thing that engineers should do, on this great economic question, was to handle it scientifically and truthfully and actually get to the bottom of the question, eliminating all passion, prejudice, politics, etc., that now was so apparent in the papers and discussions on the subject presented at the present time. He said he would not believe the figures submitted by either faction, on the question of municipal ownership, due to the fact that it was apparent that the matter was not being attacked by all concerned from a truly scientific basis with one ideal in view of solving the question on its economic value to the community as a whole. He felt that a scientific body of engineers should have it within their power to make this purely scientific study of the question of municipal ownership. The chairman of the day was Edwin H. Taylor, superintendent of construction water bureau, Portland, Oregon.

Los Angeles Electric Vehicle Meeting.

The monthly meeting of the Los Angeles Section of the Electric Vehicle Association of America was held on December 2nd at the Jonathan Club Chairman J. Harry Pieper presiding. Reports were received from the several committees. The membership committee, H. F. Kister, chairman, reported progress and presented two applications for associate membership. The garage committee, J. O. Case, chairman, reported having had several meetings with Mr. Standish L. Mitchell, secretary and general manager, Automobile Club of Southern California. This club will show on their road-maps the location of all charging stations for electric vehicles. It was voted that Mr. Mitchell be elected an honorary member of the Electric Vehicle Association of America. The attendance and publicity committee, A. T. Smith, chairman, reported that each member had been telephoned to on the morning of the meeting in order to bring out a good attendance. The result was shown by an attendance of 33 members and 5 guests. The exhibition committee, C. H. Carter, chairman, reported that they were co-operating with the papers and program committee, and would have an exhibition at the next meeting.

Mr. I. R. Solomon, one of the members, made a very strong impromptu talk on practical co-operation.

Mr. Volney S. Beardsley described in detail the plan for a week-end trip for Beardsley electric owners, a special prize being offered for those covering the greatest number of miles.

Mr. H. G. Morse, a member of the Electric Vehicle Association of America from Vancouver, now located in Los Angeles, described conditions in Vancouver and stated that co-operation among dealers was conspicuous by its absence, shown by the fact that in a city of 100,000 population there are but 37 electric vehicles.

George B. Muldaur, manager field co-operation of the Society of Electrical Development, described in an effective manner the work outlined and being accomplished by this organization. His address was most interesting and instructive. Mr. Muldaur was much impressed with the attendance and enthusiasm shown at the meeting. The next meeting will be held Wednesday, January 6, 1915.

The Jovian Electrical League of Southern California.

The weekly luncheon of the League held at Christopher's, on Wednesday, December 9th, was attended by about 150 Jovians and more than 15 guests, the majority from San Francisco, who appeared much impressed by the enthusiasm and co-operative good-fellowship displayed by the Southern members of the Order. This was evidenced by the remarks of Director Cudmore, who addressed the Jovians in his characteristic snappy fashion. R. G. Berle was chairman of the day and he had provided a splendid musical program as well as an interesting talk on "Transportation Development as Applied to Los Angeles," delivered by E. L. Lewis, superintendent of the Los Angeles Railway Company. Prefacing his talk by the statement that his company has done two million dollars' worth of paving in Los Angeles, the speaker told his hearers something of the growth of the system and its place in the life of the community.

"The Los Angeles Railway," he said, "has 4500 employes and a monthly payroll of \$300,000. On all late franchises 2 per cent of the gross receipts go to the city, while State taxes take about 5 per cent of our gross receipts."

Regarding the alleged overloading of cars, Mr. Lewis pointed out that the operating expenses of the Los Angeles Railway are nearly 74 per cent of the transportation income. This ratio of expenses to earnings, he showed from records of the State Railroad Commission, is higher than in all but two or three other cities of the country.

"Roughly," said Mr. Lewis, "it costs us $3\frac{1}{2}$ cents to handle each passenger. The reason for this is made evident in a report of the State Railroad Commission showing that, among the nineteen larger cities of the country, Los Angeles ranks first in number of miles of track per 10,000 persons.

"Of course," he continued, "some advantage will result from this undue proportion of track to the population when the density of traffic develops through the settling up of the city. But at the present time the only way open to us to cut expenses is to take cars out of service and also cut down the operating force. But the management of this road has never, and, unless forced to do so by the inroads of automobile competitors, does not intend to curtail service."

A striking set of figures that Mr. Lewis read, showed the manner in which the laying of new track here has kept pace with the city's growth. In 1890 there were fifty miles of track and 50,000 inhabitants; in 1899, 100 miles of track and 100,000 inhabitants, and at the present time, 370 miles of track and over 400,000 persons within the municipal limits.

Regarding the "jitney" bus, Mr. Lewis asserted that eventually, if allowed to run uncontrolled, they will necessarily operate to reduce the standard of the street-car service and that this will mean depreciated real estate values and a slackened outlay in both improvements and wages by the Los Angeles Railway.

At the conclusion of the talk Mr. Lewis showed a number of slides portraying the development of the system, numerous statistical diagrams and some overcrowded "jitney" busses.

OPPOSITION TO RULINGS ON OVERHEAD LINE CONSTRUCTION.

Power and light men in all parts of Idaho are greatly exercised over the proposed rules to be adopted by the public utilities commission to govern all overhead line construction by power, light, telephone, telegraph and railroad companies. On December 4th and 5th there was a meeting in Boise of the executive committee of the Idaho Power & Light Association, together with engineers of a number of the larger companies, lawyers, and others, especially interested. The matter under discussion was the nature of the proposed rules.

It will be remembered that in July last there was a hearing before the public utilities commission on this matter. At that time the different interests involved failed to agree. The power and light men insisted that the rules proposed by the telephone companies, especially, were so drastic in many of their provisions that they would raise the cost of construction for transmission and distribution lines to such a point as to make it practically impossible for the power and light companies to get out into the rural communities, and that they would drive the power and light companies off the streets and highways in many places and compel them to purchase private right of way at enormous cost in some cases. Because the representatives of the different interests failed to agree, the public utilities commission postponed action in the matter until January 11th.

The power and light men feel that the situation is a critical one for them. They insist that if the rules proposed by the telephone and railway companies are adopted and made the law of the state by the public utilities commission, that their industry will be crippled in several important particulars; that because of the greatly increased cost of line construction and other arbitrary provisions they will be barred entirely from many rural and remote communities, and to that extent the development of the entire state will be retarded.

The power and light men wish to be placed on record as favorable to rules of such character as will provide for construction safe to employes and the public. Such rules will permit these companies to go ahead with their development and extension work and bring into active production much of the territory that is now lying dormant.

Special interest attached to the meeting because of the presence of J. C. Martin, chairman of the overhead line committee of the Northwest Electric Light & Power Association, and John B. Fiskien of Spokane, superintendent of light and power for the Washington Water Power Company. This company is the largest electrical company in northern Idaho and supplies power to the Coeur d'Alene mining district. Mr. Fiskien is a member of the overhead line committee of the Northwest Electric Light & Power Association, and also a member of the executive committee of the Idaho Power & Light Men's Association.

When seen after the meeting Mr. Martin said he attended because of the deep concern the power and light interests of other states are taking in the action of Idaho.

"The Northwest Electric Light & Power Association, with which I am connected," he said, "extends over Montana, Idaho, Washington and Oregon. The matter of overhead line construction is of vital interest in all young states, especially where there is so much development depending on electric power, and where the cost of transmission and distribution lines is such an important factor.

"We realize, as everybody else does, that safety to human life is the first and most important consideration in

all these matters. We feel that the safety of employes and the public should be thoroughly protected, and still the rules for line construction be made so liberal that the electric power of the great northwest can be utilized in the development of the resources of the country."

Mr. Fiskén also spoke of the importance of the coming action of the public utilities commission.

"My company," he said "in common with all other power companies operating in north Idaho, is vitally interested in the final outcome of this hearing now on with the public utilities commission. Few people in south Idaho realize what electric power means in the development of the mining industry. This is not only important to the large properties that are operating on a broad scale, that are producing mines, but infinitely more so to prospects, or new mines that still have their way to make in the world.

"To reach many of these prospects it is often necessary to construct long transmission lines. This is expensive, and many good mining prospects must be abandoned on this account. To add largely to the cost of construction of these transmission lines, and to establish rules that would make it practically impossible to build lines through many of the narrow canyons of the north would, in my judgment be disastrous to the mining industry.

"Power men are asking nothing unreasonable. We are not opposed to rules—we court the establishment of rules and are ready to co-operate with the commission and with all other interests to the end that our employes and the public shall have every possible protection. All we ask is that fair treatment be accorded this great industry and that the power and light men be accorded every reasonable facility in assisting in developing the state."

W. T. Wallace of Twin Falls, receiver for the Great Shoshone & Twin Falls Water Power Company, was another important power man in attendance at the conference from out of town. Speaking of the matter under consideration, Mr. Wallace said:

"My company serves what many consider the most important farming community in Idaho. We have many lines now extending into rural communities, and many farmers are availing themselves of electric power, not only for light and heat, but for much of the hard farm work. Naturally the rules to be adopted by the public utilities commission for line construction is of deep interest to us because we see in the development of farming in our section the great outlet for our surplus power. It would be especially unfortunate if the rules established were of such character as to make it impractical to extend transmission and distribution lines into all rural districts where power is demanded."

THE 1915 N. E. L. A. CONVENTION.

Plans are rapidly being perfected for the reception and entertainment of the thousands of delegates who are expected to attend the annual convention of the National Electric Light Association to be held at San Francisco June 7-11, 1915. As the great Exposition will make San Francisco the Mecca of the world next year reservations have already been made in the leading hotels and arrangements are being completed to give the visitors a most royal welcome. The general convention committee, under the active leadership of Mr. John A. Britton, has been holding bi-weekly meetings since last August. Eight sub-committees have been working under the direction of a member of the general committee as chairman of each.

The guests are expected to arrive on special trains from each of the large cities throughout the country. The trains will be met by members of the committee and the delegates will be escorted to their rooms, where their every need will be anticipated. A series of luncheons, dinners and automobile parties will occupy every moment not devoted to the serious business of the convention.

The business meetings will be held in the great Auditorium in the new Civic Center. The large hall has been reserved for the week, together with smaller rooms seating a hundred or more for committee meetings.

Particular attention is to be paid to the ladies in the party, the large committee having laid out a round of amusements which will engage their attention throughout the week.

It is hoped that a large number of the Eastern visitors will arrange to spend some time in the West after the convention is over. The great hydroelectric systems with their tremendous transmission lines will be open for inspection, with every facility and comfort provided by the entertainment committee. Each of the power companies extend a most cordial invitation to visit their plants. The scenic wonders and climatic advantages of the West are at their best in June. The great Panama-Pacific International Exposition will be open and every visitor will be welcome.

An early registration with the New York office of the Association is desirable, as a beautiful guide book to San Francisco and surroundings will be immediately mailed to each delegate. A magnificent brochure illustrating and describing the great power plants of the West will also be distributed at the convention. Poster stamps, to the number of 100,000, will be supplied early in January to all who will distribute them where they will do the most good.

The lecture bureau of the Association has been provided with a complete set of lantern slides of the Exposition and will give an illustrated lecture to such of the company sections as desire to avail themselves of this opportunity.

Many other details, too numerous to list at this time, have been foreseen by the several committees. The complete list of Pacific Coast men who have been perfecting these matters is as follows:

SUB-COMMITTEES.

Entertainment.

W. W. Briggs, Chairman, 14 Sansome St., San Francisco.
S. V. Walton, Vice-Chairman, 445 Sutter St., San Francisco.
J. A. Vandegriff, Secretary, Oakland Lamp Works, 1048 16th St., Oakland.
Ralph L. Phelps, care A. Schilling & Co., 2nd and Folsom Sts., San Francisco.
R. F. Behan, Westinghouse Elec. & Mfg. Co., 165 2nd St., San Francisco.
F. W. Webster, Allis-Chalmers Co., Rialto Bldg., San Francisco.
Charles Murphy, United Light and Power Co., 511 Sutter St., San Francisco.
Thos. Finnigan, Pierson, Roeding Co., Rialto Bldg., San Francisco.
R. D. Holabird, Holabird-Reynolds Co., 523 Mission St., San Francisco.
Arthur Gunn, Wenatchee, Washington.
E. G. Robinson, Arlington, Washington.
J. E. Davidson, Portland, Oregon.
Joseph Thompson, Pacific Elec. & Mfg. Co., 80 Tehama St., San Francisco.
H. H. Cudmore, Rialto Bldg., San Francisco.

Finance.

George C. Holberton, Chairman, 445 Sutter St., San Francisco.
T. E. Collins, 2nd and Natoma Sts., San Francisco.
H. V. Carter, 575 Mission St., San Francisco.

Hotel and Local Transport.

F. H. Varney, Chairman, 445 Sutter St., San Francisco.
Wm. L. Goodwin, Pacific States Electric Co., San Francisco.
E. O. Shreve, General Electric Co., San Francisco.
F. W. Gay, J. G. White & Co., San Francisco.
Geo. Bragg, 445 Sutter St., San Francisco.
H. V. Gates, Hillsboro, Oregon.
A. C. McMicken, Portland, Oregon.
F. D. Weber, Portland, Oregon.

Ladies' Auxiliary.

T. E. Bibbins, Chairman, Rialto Bldg., San Francisco.
R. H. Ballard, Secretary, Southern California Edison Co., Los Angeles.
N. W. Brackett, Puget Sound Light and Power Company, Seattle, Wash.
C. S. McCalla, Washington Water Power Co., Spokane, Wash.
W. E. Coman, Manager Northwestern Electric Co., Portland, Oregon.
Harry Woodward, Great Western Power Co., Oakland.
Harmon Fischer, University of California, Berkeley, Cal.
R. J. Davis, Van Emon Elevator Co., San Francisco.
Chas. Wilson, 445 Sutter St., San Francisco.
Jos. S. Thompson, 80 Tehama St., San Francisco.
A. V. Thompson, General Electric Co., San Francisco.
H. A. Russell, General Electric Co., San Francisco.
J. C. De Remer, United Light and Power Co., San Francisco.

Local Registration.

W. F. Neiman, Chairman, 347 Grant Ave., San Francisco.
C. J. Wilson, 445 Sutter St., San Francisco.
A. G. Jones, General Electric Co., San Francisco.
C. H. Tallant, General Electric Co., San Francisco.
J. H. McDougal, 445 Sutter St., San Francisco.
L. M. Hardie, City Electric Co., San Francisco.
E. R. Northmore, Los Angeles Gas and Electric Co., Los Angeles.
H. H. Jones, San Diego Cons. Gas and Electric Co., San Diego.

O. B. Coldwell, Portland Railway, Light and Power Co., Portland, Oregon.
 M. C. Osborne, Washington Water Power Co., Spokane, Wash.
 Ed Quinn, San Joaquin Light and Power Co., Fresno, Cal.
 W. J. Grambs, The Seattle Electric Co., Seattle, Wash.
 George Campbell, Truckee River General Electric Co., Reno, Nev.
 Fred Hamilton, Mt. Whitney Power Co., Visalia, Cal.
 Samuel Kahn, Western States Gas and Electric Co., Stockton, Cal.

Meetings.

S. J. Lisberger, Chairman, 445 Sutter St., San Francisco.
 R. J. Cantrell, 445 Sutter St., San Francisco.
 T. C. Martin, 29 West 39th St., New York, N. Y.

Information Bureau.

Carl Heise, Chairman, 2nd and Natoma Sts., San Francisco.
 R. M. Alvord, General Electric Co., San Francisco.

Press and Publicity.

A. H. Halloran, Chairman, Crossley Bldg., San Francisco.
 F. S. Myrtle, 445 Sutter St., San Francisco.
 H. H. Cudmore, Rialto Bldg., San Francisco.
 C. F. Pierson, Southern California Edison Co., Los Angeles.
 E. A. West, Portland Railway, Light and Power Co., Portland, Oregon.
 J. E. McDonald, Secretary Joint Pole Commission, Pac. Elec. Bldg., L. A.
 J. W. Redpath, Crossley Bldg., San Francisco.

NEWS OF OREGON RAILROAD COMMISSION.

The commission has set the following cases for hearing:
 December 10, 1:30 p. m., Hood River. U-F-82, Sam G. Campbell, E. T. Hull, V. Winchell et al vs. Hood River Gas & Electric Company & Hydroelectric Company. (U-F-115, Application Hood River Gas & Electric Company to increase rates. U-F-116, Application Hydroelectric Company to increase rates.)

December 14, 10:00 a. m., Hubbard. U-F-114. Hubbard Creamery Company, S. W. Weaver and R. C. Painter vs. Molalla Electric Company, service and rates.

NEWS OF ARIZONA CORPORATION COMMISSION.

The commission has allowed the Mountain States Telephone & Telegraph Company to discontinue its exchange at Miami, Arizona, as patrons are to be served by a direct trunk line from Globe. The company has also been authorized to sell its grounded iron wire circuit between Camp Veide and Thompson's Ranch.

The hearing in the matter of the investigation of headlights to be equipped upon all locomotives operating upon railroads in Arizona has been continued until December 14, 1914.

The International Gas Company has been authorized to sell \$100,000 in 8 per cent preferred stock and \$200,000 in 20 year six per cent bonds, to furnish funds for supplying gas service in the town of Nogales.

NEWS OF IDAHO PUBLIC SERVICE COMMISSION.

Three orders were issued December 7th by the public utilities commission. Two of these related to the complaint of the Marsh Mining Company against the Washington Water Power Company. The other denies the application of the Pacific Telephone & Telegraph Company to place in effect a new schedule of rates between all points in the counties of Latah, Lewis, Nez Perce and Idaho. This application was filed November 11th. The commission finds that the effect of the schedule would be to increase many of the rates now in effect.

In the application of the Marsh Mining Company for a rehearing upon its complaint against the Washington Water Power Company, the commission has granted a hearing to be held on January 6th. Upon the representation of the mining company that it has been threatened with the removal of power wires and the discontinuance of power service by the Washington Water Power Company, the commission has made an order enjoining the power company from cutting off the power from the mining company's works, but has demanded of the mining company an undertaking conditioned for the payment to the power company of all claims in dispute or which may rise between this time and the outcome of the hearing.

During the first 11 months of the life of the commission, that part of the time for which the accounts have been made up, the total cost to the state was \$37,350.65. This amount also includes the expenses of the tax commission, which is composed of the same members as the public utilities commission, occupied the same offices and the members of which serve without salaries for this particular work. When the commissions were created the legislature appropriated \$80,000 for their work during the biennium. Therefore the work for the first period cost something more than one-third of the total amount at its disposal. The expenditures of the utilities commission used \$26,586.99 and the remainder, \$10,763.66, went toward the operations of the tax commission. Two hundred and twenty-six cases were handled by the public utilities commission during that period. Many of these were minor affairs, such as overcharges on freight or discriminations as a result of unjust rates. Further than this, the commission brought or took part in two cases, before the Interstate Commerce Commission. These were the coal rate case and the log rate case, which are now pending.

Among the more important cases which have been acted upon by the utilities commission are the power cases in the southeastern part of the state where, as a result of the influence of the commission, the rates have been lowered 35 per cent. Another case is the Hill City branch rate matter, where charges were made more equal in comparison with parallel lines. It is estimated by Mr. Miller, accountant for the commission, that the people of southeastern Idaho have been saved \$20,000 by the reduction in rates made by the Great Shoshone Power Company, \$15,000 by the Southern Idaho Power Company changes and \$7884 by the difference which the commission's rulings have made per year in the cost of water to the people of Pocatello.

As to the work of the tax commission, it is estimated that a total of \$75,000 or an excess of that has been added to the revenue of the various taxing districts over the state by additional property placed on the tax list through a scientific and systematic appraisal of the corporate property of the state and by the discovery of taxable property that had never been assessed at all.

It is estimated over the state that there was a total of \$3,000,000 placed on the tax rolls through the efforts of the tax commission. In Idaho county alone the addition is said to be more than \$750,000. Much was added to the tax rolls through the enforcement of the law relating to the collection of the personal property tax. Collections last year in this item alone are estimated to have increased \$150,000.

Another work for which the tax commission claims credit is the preparation of statistical data at the request of Governor Haines showing the source of all revenue and a classified statement of the expenditures of all political subdivisions of the state, as well as all departments of the state government. It is generally conceded that this report has done much in the way of keeping down expenditures and reducing taxes.

As a result of the appointment of John W. Graham as a member of the public utilities commission there may be some change in the policies of that body. Mr. Graham has some ideas of his own along the line of work that the commission deals with.

Regarding his attitude toward monopolies, Mr. Graham said that he was neither for nor against them, speaking generally. "Each individual case," he said, "brings its own problems. In many cases, in a state such as Idaho, the existence of a monopoly means that many sources of power will remain undeveloped and here we have almost unlimited use for electric power, it seems."

"For instance," he continued, "along the Snake River, there are power sites which, if developed, would produce energy in abundance and it seems to me to be unfortunate that they are wasted. I imagine there are other parts of the state where this same condition exists."

Schedules of rates to be charged for electric light, heat and power service have been filed with the public utilities commission by the Swan Creek Electric Company of St. Charles. These rates are for the town of Fish Haven, Idaho, only. For lighting and general household purposes the charge will be 10c per kilowatt hour. The flat rate will be two 16 candle power lights for \$1.00 a month. Power charges by this company will be 6c a month for the first 500 kilowatt hours consumption, for the next 9400 kilowatt hours 3 cents, and for any additional consumption 2 cents per kilowatt hour. The schedule will become effective January 1st. The company applied at one time for a certificate of public necessity to operate in St. Charles, but the commission found that the Utah Power & Light Company was serving that territory and refused the application.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has rendered a decision authorizing the Coast Valleys Gas & Electric Company to issue \$100,000 of its first mortgage 6 per cent 40 year bonds at not less than 90. The company proposes to use the sum of \$69,392.43 to extinguish notes payable and certain accounts payable and to apply the balance upon additions and betterments.

The Escondido Utilities Company, operating a gas and electric plant in the city of Escondido, San Diego county, has filed an application with the commission requesting authority to borrow a sum of money not exceeding \$30,000 and to execute its promissory note therefore. The company proposes to secure the payment of this note by the pledge of 45 of its bonds issued under deed of trust dated December 28, 1909, to the Los Angeles Trust & Savings Bank.

The commission has issued a supplemental order authorizing the Alta District Gas Company to acquire the system operated by A. A. Weber in the city of Dinuba. The company is also authorized to issue \$23,000 par value of capital stock to be given to Mr. Weber in exchange for his plant. The company is also authorized to execute a promissory note in the principal sum of \$10,000 payable three years after date and bearing interest at the rate of 8 per cent per annum.

The Roseville Telephone Company of Roseville, Placer county, has filed an application with the commission requesting authority to issue \$4,000 of stock to provide for additions and betterments during the coming year.

The San Joaquin Light & Power Corporation has filed an application with the commission requesting authority to renew promissory notes totaling \$92,500.

The Midland Counties Public Service Corporation has filed an application with the commission requesting authority to renew promissory notes totaling \$24,795.77.

The commission has rendered a decision authorizing the San Francisco-Oakland Terminal Railways to renew two promissory notes in the sum of \$5,890.92. These notes will bear interest at 6 per cent per annum and will be payable 90 days after date to the Railway Improvement Company.

The Western States Gas & Electric Company has filed an application with the commission requesting authority to issue \$101,000 par value of its 5 per cent bonds at not less than 82½ and accrued interest. The company proposes to use the proceeds from the sale of these bonds in reimbursing itself for expenditures made for additions and betterments to its plant.

The commission has rendered a decision authorizing the Fresno Interurban Railway Company to issue 100 shares of its capital stock of the par value of \$100 per share at a price not less than 80. These shares are to be issued in lieu of 100 shares of the company's stock purported to have been issued for the purpose of incorporation at the price of \$10 per share. The proceeds from the sale of this stock are to be used by the company for the purchase of equip-

ment in the sum of \$4,700 and for the payment of engineering, administration, legal and other contingent fees.

The commission has rendered a decision authorizing the Western States Gas & Electric Company to renew promissory notes totaling \$45,000 now held by H. M. Byllesby & Company.

The commission has rendered a decision granting a certificate of public convenience and necessity authorizing the Marin County Electric Railways to operate in the town of Sausalito, Marin county, on the condition that the present franchise shall be amended so as to allow the municipality the right to purchase the system after a period of five years. The company is also granted authority to issue 185½ shares of capital stock at par.

The Nevada-California Power Company, operating in Inyo county, California, and Esmeralda and Nye counties, Nevada, has filed an application with the commission requesting authority to execute an "open end" mortgage securing an issue of first and refunding 6 per cent 50 year gold bonds. The company proposes to use the proceeds from this bond issue in refunding bonds outstanding amounting to \$2,663,000; constructing a new power plant on Bishop Creek, and for other necessary additions and betterments.

The Southern Sierras Power Company, operating in the counties of Inyo, Kern, Santa Barbara, Riverside and Imperial, has filed an application with the commission requesting authority to execute an "open end" mortgage of its properties for the purpose of securing a first and refunding 6 per cent 50 year gold bond issue. The company proposes to use the proceeds for the purpose of refunding its outstanding obligations, for betterments and additions, for refunding its present outstanding bond issue and for the purpose of providing for future requirements.

The Plumas Light & Power Company operating in Plumas county, has filed an application with the commission requesting authority to create a bonded indebtedness in the sum of \$100,000 to be represented by 100 20 year 6 per cent bonds. At the present time, the company wishes authority to issue at not less than 80 \$52,000 par value of such bonds.

The commission has issued an order extending to January 1, 1916, the time within which the United Fuel & Power Company may issue \$197,000 of stock previously authorized by the commission.

The commission has rendered a decision authorizing the Fresno Interurban Railway Company to issue 2125 shares of common stock of the par value of \$100 per share, \$350,000 of its first mortgage 6 per cent 25 year bonds and \$350,000 of its 6 per cent cumulative preferred stock.

The commission has rendered a decision, holding in abeyance for the present its final order on the application of the Marin County Electric Railways for authority to begin construction work in Mill Valley on private funds pending the further sale of stock and receipt of deferred payments on stock already subscribed.

The commission has rendered a decision authorizing the Oakland, Antioch & Eastern Railway to issue promissory notes of the total face value of \$295,345.28. It is made a condition of the commission's order that these notes shall bear interest at not to exceed 7 per cent per annum.

NEW CATALOGUES.

Bulletin No. 32 from Wilton Manufacturing Company, Wrightsville, Pa., illustrates and describes the Wico "Hang-strait" Hickey, an adjustable malleable iron ball and socket joint hickey giving correct alignment to electric fixtures.

Bulletin No. 106 from the Wagner Electric Manufacturing Company illustrates and describes the use of single-phase motors from the central station standpoint. Facts and figures are given of the low installation cost, the high starting torque and the low starting current and good power factor of Wagner single-phase motors.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell, Secretary-Treasurer, 814 Scott, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correlate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

Requests received for information concerning protection of buildings from lightning indicate considerable interest on the subject.

When water evaporates each diminutive particle of vapor possesses a minute charge of static electricity distributed over its surface. When vapor forms a cloud the charge that was possessed by each particle is distributed over the surface of the cloud. Because the surface of the cloud is an inconceivable number of times smaller than the combined surfaces of the particles which form it, the difference of potential between earth and cloud is eventually great enough to break down the stratum of air between. Tops of structures are of course nearer the clouds than is the earth and when the path of least resistance is through a building damage usually occurs, ranging from freakish pranks to the causing of disastrous fires.

The following notes are taken from "Suggestions for Protection Against Lightning" compiled and published by National Fire Protection Association.

The idea of protection is a metallic cage with the bars, of course, considerably separated, with air terminal projections at the high points of the structure and the whole protecting cage thoroughly grounded. Protection is advisable on isolated buildings and on all buildings, however located, having elevated features. The amount of protection depends upon location, construction, occupancy, value as compared with protection expense, and frequency and severity of electrical storms. In general all metal buildings, metal chimneys or stacks need only be grounded.

Conductors of heavy copper or galvanized pipe, or equivalent, are used to connect the protecting cage to the earth. The grounds are underground water-pipe systems, ground plates or driven pipes, with preference given in order named.

Exterior metal work, such as cornice work, etc., is bonded to the conductors below the line of the metal work.

Interior metal work such as structural steel, beams, etc., (but not gas pipes) are bonded to the system at their highest and lowest points. Gas pipes are to be kept away from system as far as practicable but to have bonds placed around meter.

Tall structures such as chimneys or steeples are protected by means of two or more rods extending from the top to the ground and having metal bands around the structure at intervals, each band connected to the vertical rods.

TRADE NOTES.

The Holt Manufacturing Company will rebuild its Spokane warehouse, recently destroyed by fire, at a cost of approximately \$20,000.

W. H. Martens has decided to build and operate a small glass factory at Spokane. Local materials are said to be plentiful, including silica sand and high grade fire clay.

Pacific Coast representatives of the Edison Storage Battery Company have received telegrams that the fire damage to the plant at East Orange, N. J., was not as serious as first reported. The phonograph works were burned, but the output of other Edison products will not be affected.

The Empire Manufacturing Company of Spokane, Washington, and the Pendleton Iron Works of Pendleton, Oregon, will unite their plants and operate same at Pendleton. A rotary pump, iceless refrigerator, split wood pulley and other patented articles will be manufactured. The consolidated plant will be capitalized at \$125,000 and will employ 25 men.

On December 10th, the Power Equipment Company of San Francisco was awarded a contract for the complete installation of a large pumping plant, which is to be used on the Blevins, Mallon, Rice project. Four 24 in. centrifugal pumps, of the Worthington type will be furnished, direct connected to motors of the Westinghouse type. The contract will be completed in time for service in March. Charles De St. Maurice is engineer in charge of this project.

The newspaper reports of the Robbins and Myers fire at Springfield, Ohio, are misleading. The electrical plant was not damaged and there will be no interference in filling orders for motors, generators and fans. Arrangements have been made with adjoining manufacturers for use of their foundries and the only delay will be in transferring patterns from the Robbins & Myers plant to these foundries. Construction of a new modern foundry plant has been started. The loss was entirely covered by insurance.

In order to serve the electrical demands of the Panama-California Exposition, the San Diego Consolidated Gas & Electric Company is installing a new 4000 kilowatt steam turbine unit under the supervision of the Engineering Department of H. M. Byllesby & Company. There is also being installed three additional transformers of 1000 kilowatt capacity each. The new unit will be ready for service December 15th, although the fair does not open until New Year's eve. The hour of opening means that electricity will play a very important part in the event and the electric company is taking every precaution to have everything in readiness for perfect service. The electrical requirements of the exposition, including both power and lighting, will total about 2500 kilowatts, or more than 3000 horsepower.

SAN FRANCISCO ELECTRIC DEVELOPMENT AND JOVIAN LEAGUE.

This week's gathering was the semi-annual meeting. Many important subjects and far-reaching plans on the future operation of the League's work and upon the opening of the League after the Christmas holiday season will be taken up and actively pursued.

After the routine business was disposed of President Carl Heise, in an eloquent and earnest address, told the meeting what had been done in an effort to broaden the scope of the League's efforts; the results of the visit of Mr. Muldaur of the Society of Electrical Development of New York, while in San Francisco and the hope for still greater cooperation and closer working arrangements with the central stations. Mr. E. M. Cutting told in detail of the accomplishments of Electrical Leagues of other cities and some things which might be done by the local organization.

The new officers elected were: President, F. H. Leggett, manager Western Electric Co.; Vice-President, C. F. Butte of the Butte Engineering Co.; Secretary-Treasurer, E. B. Strong; members of the Executive Committee, Mr. C. C. Hillis, manager Electric Appliance Co.; Mr. Geo. Holberton, district manager Pacific Gas & Electric Co.

Some 50 members were present and in all the meeting was one of the most enthusiastic held during the year.



NEWS NOTES



INCORPORATIONS.

MEDICAL LAKE WASH.—The Mallory Prairie Telephone & Telegraph Company has been incorporated here.

LOS ANGELES, CAL.—Kanyak Electric & Manufacturing Company has been incorporated with a capital stock of \$25,000, subscribed \$15,000, by S. E. Gear, E. E. Hull and H. P. Kanyak.

PASADENA, CAL.—Articles of incorporation have been filed for the Pasadena Electric Welding Company, with a capital stock of \$250,000. The directors are Hugo Thornblade, W. A. Clench and S. E. McRae.

ILLUMINATION.

AUBURN, CAL.—Preliminary plans for a municipal lighting plant are under contemplation.

LONG BEACH, CAL.—The Long Beach Consolidated Gas Company is preparing to extend its system into the unincorporated territory known as Bay City.

LOS ANGELES, CAL.—The Southern California Edison Company has been awarded the contract for maintaining additional lights in Lankershim Lighting District.

SAN DIEGO, CAL.—Bids will be received up to December 28th for the installation of the Abbott Street Lighting No. 1, in accordance with specifications on file in the office of the city clerk.

LOS ANGELES, CAL.—An ordinance has been passed granting property owners permission to install a lighting system on Hollywood boulevard between Cherokee and Orchid avenues, under private contract.

PASADENA, CAL.—Electric lights are being sought by property owners of Linda Vista. Soon as the water question is settled it is likely that steps will be taken to obtain street illumination for the recently annexed territory.

WINSLOW, ARIZ.—Manager E. H. Means, of the Winslow Gas Company, has completed arrangements for the erection of a gas plant on blocks 3 and 4 of the Campbell addition. Construction work will be started immediately.

LONG BEACH, CAL.—Bids are being taken by the board of public works for furnishing electric energy for heat, light and power in this city for one year, beginning January 1, 1915, in accordance with specifications on file in the office of the board.

ANAHEIM, CAL.—Ornamental lights will be installed in the business district early in the new year. The style of posts has been decided on and the contract for the construction will probably be awarded at the next meeting of the city trustees.

FULLERTON, CAL.—The Southern Counties Gas Company has petitioned the board of supervisors to offer for sale a franchise to lay gas mains over county roads reaching from La Habra to the ocean. This strip included Buena Park, Cypress, Seal Beach and Sunset Beach. The franchise will be offered for sale December 22.

TACOMA WASH.—An ordinance has been passed by the city council providing for the improvement of C street et al by installing a system of lighting consisting of metal standards with a single globe lamp on each, the necessary wires, cables, conduits, etc., to be according to specifications of the city engineer. The estimated cost is \$17,241.

MONTESANO, WASH.—L. H. Burnett and associates closed a deal for one acre of land on the river front of Montesano on which the new gas plant will be erected. Mr. Burnett states that his company will be ready to sell gas by March 1st. Two car loads of gas pipe are on their way

here and the work of laying pipe will commence immediately.

LOS ANGELES, CAL.—In accordance with an ordinance passed by the city council declaring its intention to order the necessary appliances to be installed and electricity to be furnished for one year for lighting of Figueroa street between Sixth and Tenth streets, for the lighting of Grand avenue, between Sixth and Ninth streets, for lighting of Main street from Pico street to Thirty-sixth place, January 6th has been designated as the time for hearing all protests in regard to such improvements.

GOLDFIELD, NEV.—City lighting for Gold Hill was the topic of much spirited debate at the last council meeting when the city board of councilmen met with the committee on lighting and the representatives of competing companies. Represented by C. W. Martin, the California-Oregon Power Company made a bid for the city lighting on a ten year contract, specifying eighteen three-cluster lights of the type now in service at the News corner, thirty-five single lights on neat wooden standards, sixteen lights on iron standards, and one large cluster of three lights at the bridge, to be completely installed and maintained at a cost of \$55 per month the system to be in operation within thirty days. F. W. Dodge, engineer of the Rogue River Public Service Corporation, which is now developing an extensive power project at the city limits, agreed to duplicate the rival company's bid of specifications, constructing an entire new pole line throughout the city, at a cost to the city of \$50 per month for service. On behalf of his company Mr. Dodge further offered to furnish a surety bond to the city in the amount of \$5000 for the construction of the system and its satisfactory operation within 60 days, explaining that the additional delay would be necessary to permit the completion of work upon the dam now building. After a heated discussion the council decided with one dissenting vote to award the contract to the California-Oregon Company.

TRANSMISSION.

WEAVERVILLE, CAL.—The supervisors of Trinity County have advertised for bids for a franchise as applied for by the California-Oregon Power Company to operate within the county.

SEATTLE, WASH.—The Puget Sound Traction Light & Power Company is constructing a power transmission line from its White River station to the plant of the Carbon Hill Coal Company at Carbonado, Wash.

SEATTLE, WASH.—The Northwest Development Company is making ready to invade the Coeur d'Alene mining district in Idaho with electric power competition. Transmission lines are now being constructed into this region by the new company.

JUNEAU, ALASKA.—The Alaska Electric Light & Power Company, Juneau, Alaska, has practically completed its extensive development program and has expended something like \$75,000. The plant has a capacity of 1500 kilowatts with its steam and water power combined.

LONG BEACH, CAL.—An ordinance providing that all electric wires be placed underground was taken from the table at a recent meeting of the city council and adopted on third reading with minor amendments, which stipulate that work shall begin on the proposed improvement not later than July 1st, next year, and be completed before the end of 1915.

SAN DIEGO, CAL.—The county board of supervisors has under consideration a petition for a franchise for electric

light, power and transmission lines from Escondido through Rincon, San Marcus and San Pasqual valleys. It is proposed by the Escondido Mutual Water Company to build an electric transmission line from its power plant on San Luis Rey River to the power plant below the reservoir, thence to Escondido.

LOS ANGELES, CAL.—D. S. Parks has filed with the board of public works a condensed report of the aqueduct power project up to November 30th, which shows the work now under way totals \$3,550,895. This includes the San Francisquito Canyon plant No. 1; waterway leading from Elizabeth tunnel to plant No. 1; waterway leading from plant No. 1 to aqueduct tunnel No. 73 and the cost of necessary equipment, such as pipe lines, etc.

SALT LAKE CITY, UTAH.—One of the most important steps taken by the Utah Light & Traction Company this year in furtherance of the civic beauty idea that has gained headway in this city was completed during this week when the engineering department of the company completed the work of "cutting over" from the overhead wires to the conduit cables, the current transferred from the main power supply station on the Jordan River to the West Temple plant, for operating the railway system and the commercial district lighting and power currents. This work has been in progress for several months, the conduit crew keeping just ahead of the paving contractors, who have had improvement work in that part of the city. As a result of cutting over this current the work of removing the forest of poles, carrying hundreds of wires, is now being carried on and will be completed within a few days. By reason of this improvement West Second South street is being made one of the finest business streets in the city, on a par with Main street, State street, Broadway and other thoroughfares in which the traction company has completed this work. The cost of this improvement in round figures is somewhat in excess of \$30,000.

AMERICAN FORK, UTAH.—Recently Mayor Gurney and City Councilmen Wing and Evans filed on the power site located at the mouth of Deer Creek in American Fork Canyon. While the filing is in the names of the above named gentlemen, it is given out that it was done with the intention of holding it for the city. At the present time the city could not bond for enough money to install a plant and the necessary lines, etc., which would cost in the neighborhood of \$100,000. It is probable that the next legislature will pass a law increasing the limit of the city's indebtedness for this purpose. The filing covers that made by C. W. Earl several years ago, and is considered to be one of the best undeveloped in the state. The petitioners ask for 17 second feet of water from American Fork Creek proper and 3 second feet from Deep Creek. They will be commingled together in a reservoir to be built on Silver Lake Flat, from which place the water will be released for water purposes as needed. The project will require a wooden stave pipe line 18,000 ft. long to get the canyon proper water into the reservoir, and another pipe line 6000 ft. long to get the Deer Creek water into the reservoir. The natural low water flow of the combined streams is 20 second feet, but this will be greatly increased by reservoiring the flood waters. The pipe line from the reservoir to the power house site is 7542 ft. long, the lower part of which will have to be most expensive steel pipe. The proposed plant will have a capacity of about 1500 horsepower. While the city has no present intention of building the plant, the officials thought that it would be good safe policy to file on the site, which was entirely agreeable to Mr. Earl, who has spent hundreds of dollars in filings, surveys and securing data. If the coming legislature grants the necessary increased bonding privilege and the citizens generally show a disposition for the city to own its own plant, then it is probable that the plant will be built.

TRANSPORTATION.

MILWAUKEE, ORE.—The council has granted a 25 year franchise to the Portland & Oregon City Railroad, Stephen Carver, to operate an interurban line through Milwaukee.

SEATTLE, WASH.—Corporation Counsel Bradford holds that it is legal for the city of Seattle to operate that part of the Lake Burien car line extending outside the city limits.

BOISE, IDAHO.—C. J. Franklin, a civil engineer of Boise, Idaho; J. G. Brown, finance commissioner of Galion, Ohio, and E. A. Pack of Weiser, Idaho, are considering the construction of an interurban road over the Blue Mountains from Boise to La Grande, Oregon, a distance of 75 miles.

SAN FRANCISCO, CAL.—M. M. O'Shaughnessy, city engineer, has been directed to prepare plans and specifications for the proposed line of the Municipal Railway through Golden Gate Park into the Sunset District. The supervisors have unanimously adopted a resolution to that effect. The line will be routed through the park from the present terminus of the road at Tenth avenue and Fulton street, running in back of the Museum and skirting Strawberry Hill near the Japanese tea garden. The cars will emerge at Fourteenth and run up to Kirkham street.

FALLON, NEV.—At a meeting of the stockholders of the Fallon Electric Railroad Company last week the following officers were elected: C. A. Hascall, president; H. A. Lattin, vice-president; E. S. Berney, general manager and treasurer, and A. E. Wilson, secretary. These officers, together with A. Baumann, constitute the board of directors. The company plans to push the work on their grade to Sand Springs and hopes to have it completed at an early date. About 12 miles of the grade have been completed. The Berney Construction Company has taken the contract to complete the grade to Sand Springs and to install all bridges and culverts.

BOISE, IDAHO.—Judgment for \$195,129 was given E. H. Jennings of Pittsburg Tuesday, against the Idaho Railway, Light & Power Company and O. G. F. Markus, receiver. This was tried some time in the spring and was taken under advisement by Judge McCarthy. Mr. Jennings, who is a Pittsburg capitalist was the first to subscribe \$100,000, which enabled W. E. Pierce to take over the old Boise Railway Company and inaugurate the Boise Interurban Line. When Mr. Pierce sold out the Boise & Interurban to the Idaho Railway he received cash for his interest, but Mr. Jennings, according to Mr. Pierce, agreed to take his \$180,000 interest in stock. This debt was never paid to Mr. Jennings in any way and the present judgment is to cover the amount, together with \$11,000 in interest and attorney's fees.

OGDEN, UTAH.—The Salt Lake & Ogden Interurban Company has completed its road bed for the west track on Lincoln avenue, between Twenty-sixth to Thirtieth streets, and cars will be operated over it in a few days. This roadbed is laid with metallic ties and reinforced concrete. The east track in the same district will be made of the same material, but it is said that the work will be delayed until after the winter months. The avenue along this new roadbed was laid in concrete during the summer months. The company is also building double track from the south side of Twenty-fourth street, at the intersection of Lincoln avenue, to the "Interurban Terminal" in the center of the block, between Grant and Lincoln avenues and between Twenty-third and Twenty-fourth streets. A steam shovel is being used to excavate for the roadbed and a large concrete mixer is on the ground. Metallic ties are also being placed on this part of the road and 85 pound rails are being used. Double tracking on Lincoln at Twenty-fifth street has been extended over the intersection and it is said by officials of the company that the road will be double-tracked the entire distance between Twenty-fourth and Twenty-fifth, early in the spring of the year.

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119 East Seventh Street, Los Angeles; 507 Sixteenth
Street, Oakland; 680 Folsom Street, San Francisco;
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SAN FRANCISCO, DECEMBER 26, 1914

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DIESEL ENGINE IRRIGATION PLANT.

BY MAX LOEWENTHAL.

ARC LAMP PHOTOMETRY.

BY STEPHEN CARLETON ROGERS.

THE STORAGE BATTERY.

BY H. N. SESSIONS.

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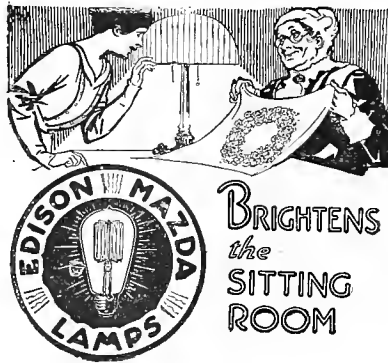
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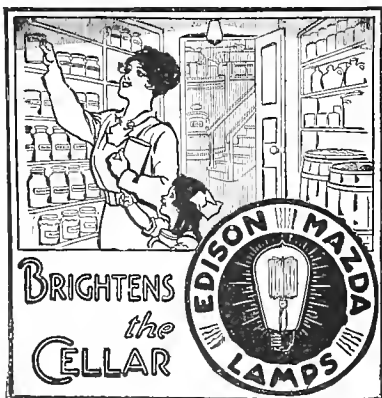
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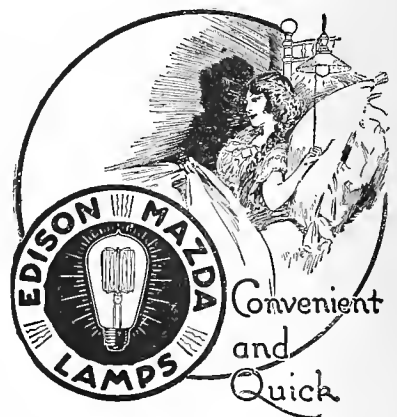
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VOLUME XXXIII

SAN FRANCISCO, DECEMBER 26, 1914

NUMBER 26

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A DIESEL ENGINE IRRIGATION PLANT

BY MAX LOEWENTHAL

The beautiful little town of Corona, situated about fifty miles southeast of Los Angeles, which has only recently, so to speak, been placed on the map of the world through the record breaking speeds attained by the racing autos spinning around the circular track surrounding the town, can lay claim to

figuring 400 boxes per car, means an annual yield of over 90,000 boxes of packed fruit. Considerable business capacity and foresight must be exercised in the management of a plant of this size and as its efficiency depends very largely upon the condition of the soil. The solution of the water problem for irrigation pur-



Diesel Engine Pumping Plant at Corona.

further distinction in view of its extensive and highly productive orange and lemon groves and because it harbors within its confines one of the most unique and economical deep well irrigation pumping plants in this country.

This plant was installed by the Los Angeles branch of Henry R. Worthington about three months ago on the extensive Jameson ranch and has been operated successfully for twenty-four hours each day almost continuously during that time.

This ranch, which is about twenty-two years old, consists of 450 acres of citrus fruit groves of which 250 acres are in bearing trees. There are about 32,000 lemon and orange trees on the ranch, giving a yearly output of about 225 carloads of fruit, which,

poses, that is, a dependable supply in sufficient quantity and secured at a cost which is not prohibitive, was one which gave the owners much concern and was carefully studied before a final decision was arrived at.

It would seem almost self-evident, when the statement is made that an electrical high tension line runs directly over the roof of the present pump house, that an electric motor would have been installed for the operation of the pump, but as such is not the case, the plant at once becomes of unusual interest to the engineer. In the words of Mr. Joy G. Jameson, who decided in favor of the present equipment, which entailed an expenditure of about \$18,000, inclusive of the well work: "Even if we should have been able to obtain current at from $\frac{1}{2}$ to 1 cent per kw,

it would not have paid us to lift the quantity of water required from a depth of over 400 ft. by means of electricity, while the present installation is a profitable and satisfactory investment from every standpoint."

While the conditions here are, no doubt, extraordinary, it must be conceded that most of the 2000 pumping plants which have been installed in Southern California during the past two years, are electrically-driven. But this plant may serve to open up new opportunities for irrigation which have hitherto presented problems considered impossible of solution.

In order to strike pure water, it was necessary to sink a well 630 ft. in depth, while the pump has a lift of 425 ft. and a capacity of 45 in., which is equivalent to a delivery of 405 gallons of water per minute. The installation within the corrugated iron

generator was installed, which is operated by means of a friction pulley from the main flywheel of the Snow engine, thus making the plant entirely independent of outside current supply.

The engine uses 18 gravity California crude oil, kept in a 50 gallon service tank, some distance from the plant. The oil consumption for the operation of this pump is less than two barrels per 24 hours, at a cost of about \$1.00 per barrel.

The crude oil engine is distinguished from the explosive engine, such as gas, kerosene, or gasoline engines, in that the impelling force applied to the piston is not an explosion of a fuel and air mixture, but a complete combustion of the fuel in highly compressed air. This form of combustion permits the engine to run evenly and quietly, increases the durability of all moving parts and is particularly well

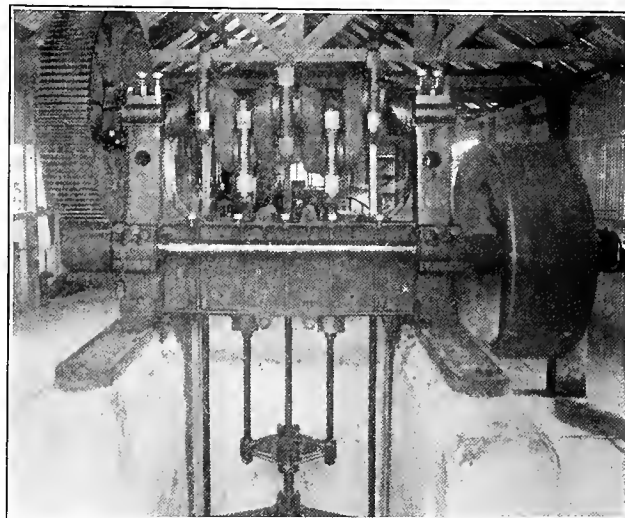


Jameson Ranch Pump House.

pump house, 20 ft. x 50 ft. in size, standing at the edge of one of the extensive lemon groves, consists of the following machinery: A 65 h.p. 4-cycle Snow crude oil engine, of the Diesel type, together with a 3x4 triplex water jacket pump, a $1\frac{3}{4} \times 2\frac{1}{2}$ triplex fuel oil pump, a $3\frac{1}{2} \times 3\frac{1}{2}$ air compressor for starting the main engine, an 8 h.p. distillate engine for operating the compressor and operating a heavy pattern, double gear hoist, used in connection with the deep well pump to enable quick handling of rods in case of emergency.

The crude oil engine, which operates at a speed of 225 r.p.m., is connected by means of a 16 in. belt with 34 ft. centers to a Glendora triple plunger pump with $9\frac{1}{2}$ in. triple buckets operated by rods weighing 13 tons. This pump, which is thrown into action by means of a clutch, as shown in the illustration, is surmounted by a 65 ft. derrick extending far above the roof of the house, by means of which two lengths of column pipe or two lengths of triple rods can be handled at one time, thus saving one-half the time in case of emergency.

For furnishing current for the 24 incandescent lamps in the house, a small 2 h.p. General Electric



Power Head of Glendora Deep Well Pump.

adapted to close regulation. No ignition apparatus is necessary, as the fuel is self igniting in the highly compressed air in the combustion space. The engine is at all times ready for operation, as no heating up of any vaporizing chambers or other parts is necessary. The engine can be started, brought up to speed and ready to take full load in less than a minute. The movement of a single lever puts the engine in service, and when not in service, there are no stand-by losses.

On this four cycle engine at the first forward stroke of the piston, air is drawn into the cylinder, completely filling it. On the return stroke this air is compressed into the clearance space to about 500 lb. pressure, and as the piston approaches the end of the stroke, the spray valve is suddenly opened, and the fuel which was deposited in the spray nozzle on the suction stroke is at once thoroughly atomized and injected into the clearance space, causing complete combustion in the highly compressed air, the combustion thus imparting its energy to the piston on the outward stroke without subjecting its parts to any shock. The fourth or exhaust stroke then takes place, completing the cycle.

The pump gives approximately three times the volume of water that can be obtained with a single-acting pump of the same size and approximately fifty per cent more than either the double-acting or the two-plunger pumps.



LIGHTING METHODS

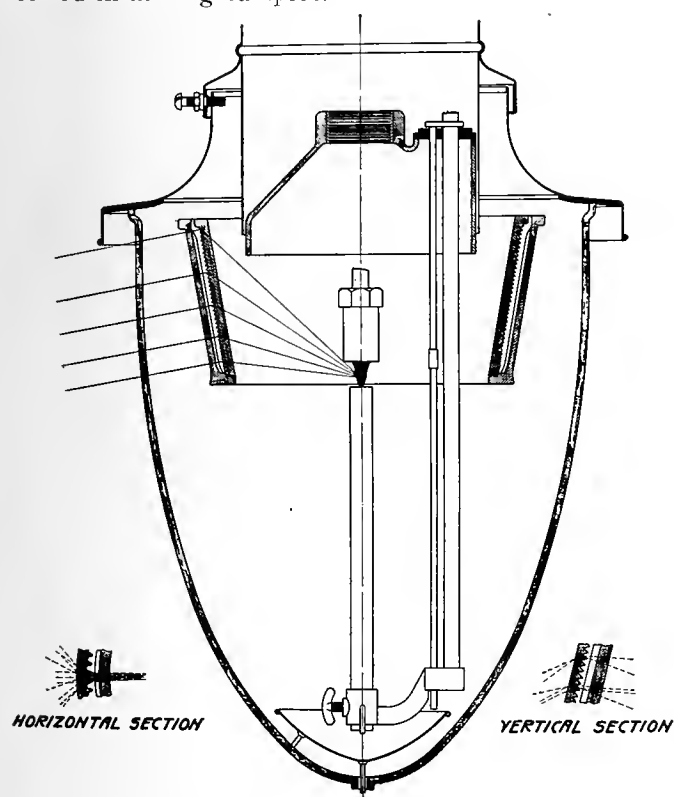


LETTER TO THE EDITOR.

Arc Lamp Photometry.

Sir:—I have just read an article in the October 10th issue of the Journal of Electricity, Power and Gas, entitled "Arc Lamp Photometry," by Ford W. Harris. This article as a whole is very good, but there are several statements and impressions I would like to have corrected.

In the third paragraph of this paper, Mr. Harris comments upon the variation in candle power or the average light given by electrodes, particularly those used in the magnetite arc lamps. He states that this variation in electrodes can be easily exaggerated if desired in mixing samples.



Magnetite Arc Lamp With Prismatic Reflector.

In the first place, these magnetite electrodes are made by only two companies which are the largest and most reliable manufacturers of electrical apparatus in the United States, and I know that one of these two manufacturers does not and the other would not stoop to such a practice. At the present time there are two distinct types of electrodes, one commonly known as the "long life" electrode and the other as the "high efficiency" electrode. Secondly, neither of these manufacturers would be apt to place on the market an electrode which would give trouble from slagging and unsteadiness.

Mr. Harris' method of testing arc lamps is open to serious error. His method is to determine the shape of the distribution curve quite apart from the luminous intensity, then to determine the "intensity at a certain angle" and finally to find the average total life over a long period. The shape of a distribution

curve, particularly with a magnetite arc lamp, differs extremely with the length of arc, and since this length of arc is different at various currents, it will be seen that the shape of the curve for 4 amperes will be different from that at 6.6 amperes or other current, and, if this shape has been determined at some unknown current and some unknown intensity, no matter what the "intensity at a certain angle" may be, it would be impossible for him to plot this "intensity" and obtain an accurate distribution curve of the arc lamp.

When complete distribution curves of arc lamps are made in the arc lamp photometric testing laboratory, two or three observers each take at least ten readings at every 10 degree angle (and some of the 5 degree angles when necessary) and several complete sets of readings are made, using different electrodes taken at random from stock. The readings are taken at designated automatic time intervals, thereby eliminating an error which Mr. Harris did not mention, since the observer will read not only the high values but the low ones due to the instantaneous position of the arc, such as directly after feeding, etc. These sets of readings, taken by different observers and with different electrodes are all averaged together and the curve is plotted from these averaged values. In addition to this test, electrodes are also sent to the illuminating engineering laboratory where check tests are made by different observers and with other electrodes. This laboratory is wholly independent from the arc lamp testing laboratory and moreover is even in a different state.

Sometimes a curve is made, from only one or two electrodes and possibly only one or two complete sets of readings. Therefore in such cases, the curves thus made are marked "preliminary" to distinguish them from the other standard curves.

Whenever the material for a new lot of electrodes is prepared, a number of electrodes are made up from this mixture, put on life test and photometric readings made at different times during their life.

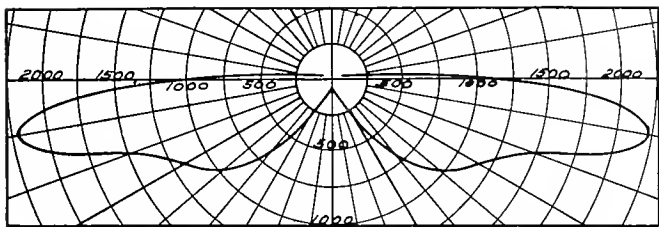
The candle power and life must come within predetermined limits before approval can be granted to release this mixture for the making up of electrodes. All of the raw material is analyzed very carefully by several expert chemists and handled in a scientific manner, the raw materials being both magnetic and water separated.

In the latter part of the paper the author states "The two points most interesting to a user is the light emitted at an angle of 15 degrees below the horizontal and the shadows cast. . . . That lamp is the best which throws no shadows, and no amount of distribution curves can effect a practical demonstration of this kind." If the shadow is directly underneath the lamp, this objection disappears, since at the present time practically all lamps, arc or incandescent, are giving too much light, if anything, directly underneath and not enough in the spaces half way between the lamps, so a shadow here is unobjectionable from an illumination standpoint. Shadows have practically no effect on the illumination but look bad if too pro-

nounced. Any other shadow from an arc lamp that is objectionable may be eliminated if desired by the use of a diffusing globe instead of a clear globe, and, in some cases by merely sand-blasting the bottom of a clear globe, and this is particularly recommended whenever lamps are hung low, that is 20 ft. or less.

In the last paragraph, the statement is made that "The candle power of arc lamps is regularly over-estimated by the manufacturers." This is not the case, in fact, the values as given out are under rather than over-estimated. A statement is made that the 4 ampere magnetite gives a maximum between 450 and 600 candle power and the 6.6 ampere magnetite from 800 to 1200 candle power, depending on the electrodes. The 4 ampere magnatic lamp, thousands of which are in operation throughout the United States at the present time, gives a maximum of 630 candle power at 10 degrees below the horizontal with the long life electrode.

The 6.6 ampere lamp equipped with the long life electrode gives over 1500 maximum ray candle power



Photometric Curve of Magnetite Luminous Arc Lamp.—75-80 volts, d.c. series circuit, 5 amperes, 206 lumens per watt. Upper electrode 1 in. dia. copper; lower 11/16 in. high efficiency mix.

and electrodes giving any such discrepancies as stated by Mr. Harris could not leave the factory. These lamps of course are equipped with clear globes.

Since receiving this Journal of October 10th, a dozen of these long life electrodes were selected at random and tested out in the two distinctly separate laboratories above mentioned and all showed values well above those shown on standard curves.

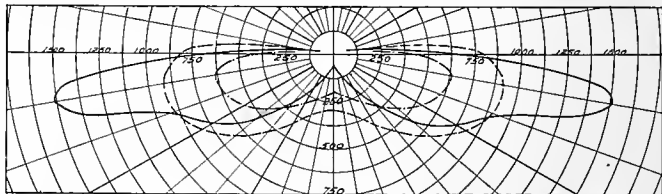
Perhaps Mr. Harris in this article referred to these lamps when equipped with diffusing globes and if so his values would be approximately correct, depending of course on the density of the globe used, but it has not been customary to give values when equipped with diffusing globes unless that fact has been so stated since this is due to the very wide variation in globe densities and globe absorptions.

He also states that "The 4 ampere magnetite is at present the most practical arc lamp for residence street lighting and the luminous flame or impregnated carbon arc the most practical for display or business street lighting. It is probable, however, that unless rapid improvements are made in arc lamps that the new nitrogen filled tungstens will largely supersede them."

I will consider the last sentence first. It is evident that Mr. Harris has not kept in very close touch with the recent improvements made in arc lamps. In the March, 1914, "Lighting" issue of the General Electric Review there appeared an article of considerable length by Mr. C. A. B. Halvorson Jr. on "Improvements in the Magnetite Arc." In this article Mr. Halvorson wrote about the new high efficiency magnetite electrode. The lamps referred to above when equipped

with the high efficiency electrodes will give 925 candle power maximum at 4 amperes and 2100 candle power at 6.6 amperes with clear globes, thereby reducing the specific consumption of these lamps from .63 to .42 watts per mhscp for the 4 amperes and from .403 to .31 watts per mhscp for the 6.6 ampere lamp. More recent than this, however, a new design of magnetite lamp has been brought out to which has been adapted a specially designed prismatic refractor.

This prismatic refractor consists of two truncated conical glass globes, open at the top and bottom, fitting inside one another and forming a single unit which is smooth on both inside and outside surfaces. The inner section is girdled by a succession of horizontal prisms which intercept all the available light rays given off from the arc above the horizontal and deflect them downward at an angle of 10 degrees below the horizontal, (as shown in the vertical section in the accompanying illustration), which is generally accepted as the most useful angle for the lighting of streets and large areas. The inner surface of the outer



Photometric Curves of Magnetite Luminous Arc Lamp.—Heavy line, Form 17 Lamp, No. 449 Refractor, 11/16 in. high efficiency electrode. Broken line, Form 3 Lamp, Int. Reflector, 5/8 in. high efficiency electrode. Dotted line, Form 3 Lamp, Int. Reflector, 5/8 in. Standard electrode.

Electrode	High Efficiency.	Std.
Equipment.....No. 449 Refractor	Internal Reflector	
Volts at terminals.....75-80	75-80	75-80
Amperes.....4.	4.	4.
Watts at terminals.....310.	310.	310.
Mean hemispherical C.P.....741.	736.	488.
Watts per M.H.S., C.P......42	.42	.63
Mean spherical C.P.....425.	385.	256.
Watts per M.S., C. P......73	.81	1.21
Lumens per watt.....17.2	15.6	10.4

section is lined with a series of vertical prisms which serve to diffuse the light (as shown in the horizontal section).

By the use of this refractor the maximum values are materially increased at 4 amperes. This means a maximum of 900 candle power with the long life electrode and 1500 candle power with the high efficiency electrode and 3250 candle power at 6.6 amperes. At the same time there has been standardized a magnetite arc lamp which operates at 5 amperes and has a very low specific consumption. When equipped with this prismatic refractor this gives a maximum of 2200 candle power at 5 amperes.

This new lamp at 4, 5 or 6.6 amperes may be used with or without the prismatic refractor. When used without prismatic refractor it should always be equipped with a proper diffusing globe. The maximum values in this case are very much reduced.

In regard to the 4 ampere lamp—I agree that the most practical arc lamp for residence street lighting is the 4 or 5 ampere magnetite arc lamp, but the ornamental luminous arc lamp, at 4, 5 or 6.6 amperes, of which there are over 10,000 in the business districts of 80 odd cities, is the best for display or business street lighting.

STEPHEN CARLETON ROGERS.
West Lynn, Mass.

STORAGE BATTERIES

(The three papers on storage batteries which were presented at the Dec. 8, 1914, meeting of the Los Angeles Section of the American Institute of Electrical Engineers are here printed in full. Mr. Sessions, who is commercial engineer with the Southern California Edison Company, gives a rapid fire resume of the subject, Mr. Solomon, as the representative of the Gould Storage Battery Company, upholds the lead type, while Mr. Rogan, as the agent for the Edison battery, describes the alkaline battery. Taken together they form a practical symposium on the subject.—The Editor.)

THE STORAGE BATTERY.

BY H. N. SESSIONS.

I plead guilty before this meeting to the charge of battery. Knowing the seriousness or specific gravity of such a charge, I expect that you will sentence and confine me to a storage cell for one ampere hour; hence reading this paper at 10 ampere rate will give you six minutes of plain talk on storage batteries.

Since Plante, the famous French electrician, gave us the first practical storage battery fifty-four years ago, its career, till now, has been unsettled. Its uses were special and limited. At last we have found a need for it so general and extensive that we shall soon debate in our minds which was responsible for the other, the electric vehicle or the storage battery. Our modern gas car depends on the storage battery for ignition, lights, horn, self-starter and the electrical shifting of gears. The next stride of evolution gives us the all-electric vehicle, the very heart of which is the storage battery. This has put the storage battery to such universal use that, like the camera for example, it is being operated by the amateur and the professional with good results to both when it is understood and cared for.

We, in the electrical business, engineers, salesmen, etc., are looked upon alike by the public as electrical men posted on electrical affairs. We have the name and are credited with the game, so let us play it today with storage batteries as trumps. The practice will fit us to deserve the reputation we enjoy and enable us to give wholesome advice to the layman.

We are familiar with the many species of voltaic or primary battery which develops electrical energy by the direct chemical decomposition of the solution or electrolyte and of one or both its elements. The storage or secondary battery, sometimes termed the accumulator cell, differs from the voltaic or primary battery in that, although quite inactive or inert in itself, yet, on passing an electric current through it, certain chemical changes are induced rendering it capable to receive, hold and redevelop electrical energy. Chemistry is picking for us a combination for the storage battery composed of the proper constituents for the ideal with higher capacity, less weight and longer life or endurance. The high development of these three qualities is marked today in the lead-acid and the nickel-iron-alkaline or Edison battery, the lead battery standing for high electrical efficiency and short life as against the Edison battery of lower electrical efficiency compensated for by longer life. While their chemical constituents differ, these two classes of battery are practically the same in principle of construction and operation. Each consists of a positive and negative element immersed in a solution or electrolyte. The difference of potential between the positive and negative plates or elements is acted upon by the electrolyte, causing a current to be chemically

produced. The rate of a battery's delivery in amperes per hour is governed chiefly by the area of its plates and the electrical resistance of the intervening electrolyte. Strange to say, the electrolyte which is a good conductor at the proper specific gravity, is composed of two very poor conductors. For example, pure water and sulphuric acid separately have a high electrical resistance, but in combination by weight one-third acid to two-thirds water, approximately 1.250 specific gravity, we have a conducting medium of low resistance. This same feature exists with the caustic potash or alkaline electrolyte. It is peculiar to note that sulphuric acid and water occupy less cubic volume in combination than when separated. This fact, together with the heat evolved when they are mixed, seems to prove that the acid electrolyte is a chemical rather than a physical combination, thus explaining why an acid solution does not stratify as the alkaline electrolyte does when standing idle at low temperature. Such strata necessarily are of various specific gravities either above or below the average gravity of least resistance. This is my only explanation as to why the Edison cell does not accumulate its charge as readily as the lead-acid cell on extremely low charging currents. A good wrinkle for making acid electrolyte quickly in an emergency is to mix sulphuric acid with clear ice, thus insuring a cheap, cold distilled water electrolyte ready for use. Sulphuric acid attacks steel. Potash preserves it, hence the Edison battery is contained in steel, and the lead-acid battery in rubber. This is an enormous advantage in favor of the alkaline battery as the steel jars are not only stronger than rubber, but radiate their heat better. I hope we may yet see the lead cell encased in a steel jar protected inside and out with a lead coating which will not be attacked by sulphuric acid.

Referring to the preserving effect of an alkali on steel, please do not believe James F. Rogan, agent for the Edison storage battery if he tells you that an alkali solution is good to drink. James knows the difference between alkali and alcohol. Oh! You Rogue—an alka-liar. The watt-hour efficiencies of the nickel-iron-alkaline and the lead-acid batteries are approximately 60 per cent and 80 per cent respectively; hence each of these classes of battery must receive the necessary excess charge to compensate for their deficiency.

The voltage of a storage cell signifies little unless taken while current is passing through it either in charge or discharge. It then becomes a truthful indicator of the cell's condition. The voltage of a cell is simply the difference of potential between its plates or elements and is the same regardless of the size or weight of the battery. The size and weight of the plates however, determine the output or capacity of a cell ordinarily measured and expressed in ampere hours. A complete account of the chemical reactions in the storage battery is too extensive to be given here,

but the eventual result of charging any storage battery is, that water is decomposed into its constituents, hydrogen and oxygen gases. The oxygen is liberated at the positive plate, which becomes highly oxidized, while hydrogen is accumulated at the negative plate. In discharging, the oxygen of the positive plate decomposes the electrolyte, combining with its hydrogen, and so travels through to the negative plate, combining with it. The plates of any storage battery consist of a suitable metallic frame or grid which holds what we term active-material. In the lead battery this active material is peroxide of lead at the positive plate and pure porous lead at the negative. In the Edison battery the active material of the positive plate is nickel-oxide and of the negative plate metallic iron. Ampere hour capacity is largely proportional to the volume of oxidizing or active material held by the plates, consequently the cubic size and weight of a cell is in fair proportion to its ampere hour output or capacity. The active material of a storage battery must at intervals be expanded by charging to its fullest extent, otherwise it will shrink and cease to be porous and wholly active just as our lungs would become without an occasional full breath. Starving a storage battery by undercharging it is poor economy, particularly with a lead battery, because such practice will entail long overcharging at a low rate followed by many cycles of charge and discharge to eradicate lead sulphate in the active material and bring the specific gravity back to normal. More injury is done a storage battery by allowing it to heat in charging than in any other way. The best results are obtained when the temperature is kept below 90 degrees Fahrenheit. It should never be allowed to rise above 100 degrees Fahrenheit. The lower the temperature is kept during charging, the longer will be the life of the battery, and the shorter can be the time of charge, if necessary. It is astonishing how rapidly a battery can be charged when the temperature is kept down. After all is said and done, if these three features, namely, specific gravity, voltage and temperature, are watched and kept within normal bounds while charging and discharging, any standard type of storage cell today will give satisfaction.

The public conception of the vehicle storage battery is a set of clammy, uncanny, black coffin-like trays containing very heavy sloppy boxes or cans full of a mysterious electrified fluid that spits, sparks, smokes and smells, commonly called "juice."

THE EDISON ALKALINE STORAGE BATTERY.

BY JAMES F. ROGAN.

A storage battery is commonly looked upon as a receptacle in which to store electricity. Electricity is not concrete matter. (In fact nobody knows just what it is.) Therefore, in the general comprehension of the term, it is not stored. Electricity simply causes a chemical change to be effected in certain substances, when it is caused to flow through them. These substances, in endeavoring to return to their original state, produce electricity.

Suppose we place two pieces of very thin bright steel out of doors for a few weeks. They become "rusted." The action of the oxygen on the outer layer

of the metal has formed it into an oxide commonly known as "rust."

Now, let us place these two pieces of steel into a solution composed of potash and water, and connect them by wires to a small dynamo. The electricity, in flowing from the dynamo through the solution, from one of the plates to the other, and back to the dynamo, changes the rust to metallic iron on one of the plates, but causes the other plate to become "rusted" twice as much as before.

Now, let us disconnect the plates from the dynamo and connect them, by means of pieces of wire, to an ammeter. Instantly, the excess oxygen in the rust on the one plate commences to pass back to the bright plate and, by so doing, causes electricity to be generated. Why? Nobody really knows.

We have now charged and discharged a primitive storage battery.

Instead of two thin rusted steel plates, let us mount, say, one hundred such plates, equidistantly spaced, on one rod, and one hundred more on another rod. Now suppose we interpose the two groups so the plates of the two groups will not touch each other, and then connect them to our dynamo. The electricity will flow from one group, through the solution, to the other group, converting the oxide of one group to metallic iron, and increasing the amount of oxide on the other group. We will be able to get much more electricity from the battery thus formed, because of the greater plate surface exposed.

We have thus determined that large surface is necessary.

Let us next place a lot of fine particles of iron rust into two perforated flat steel pockets and, after putting these pockets into potash solution, pass electricity from one to the other, through the solution, as before. All the iron rust in one pocket will be changed to metallic iron, because the oxygen will have passed over to the iron rust in the other pocket, causing this material to possess twice as much oxygen as before. The super-oxidized pocket tends to swell to a cylindrical shape.

Now, when you connect the two pockets to your ammeter, you will find that much more electricity is flowing than before, although the two pockets take up much less space than the two hundred steel plates. The reason of this is, the small particles present a very great combined surface to the solution.

Suppose, after having a great number of experiments, you find if you put some iron rust—iron oxide—into perforated steel pockets, and mount a lot of these pockets on a steel grid or support to form one plate, and place nickel hydrate (a green powder) into perforated steel tubes, and mount these tubes on another steel grid to form the other plate, you will have arrived at the point Mr. Edison reached when he discovered the Edison storage battery.

The electricity, in flowing through the solution from the "tube" or positive plate to the "pocket" or negative plate, causes the oxygen in the iron oxide of the pockets to come over to the green nickel hydrate. This oxidizes the hydrate and forms a new kind of nickel oxide, heretofore unknown chemically. This oxidizing of the hydrate tends to cause the tubes to swell. But they are already round—cylindrical—

and are furthermore reinforced by a number of seamless steel rings placed around them. It is therefore apparent that they cannot swell.

We continue to pass the current through until the iron oxide in the pockets has been converted into metallic iron, and the green nickel hydrate, in the tubes, becomes black nickel oxide. Then when we connect these two plates to our ammeter, the increased capacity will be apparent.

At this point we still find, however, there is room for improvement, just as Mr. Edison found.

Some substances permit more light to pass through them than do other substances. Likewise, some substances present greater resistance to the passage of electricity through them than do other substances. This nickel oxide in the positive plates has high electrical resistance. So it becomes necessary to divide it up into very thin layers, and to conduct the electricity to these layers by intervening layers of metal.

I will explain to you later how this was accomplished. It was exceedingly difficult to achieve, and cost Mr. Edison much money and effort.

The loading of the tubes is accomplished by an automatic machine operating as follows:

After the perforated steel tubes have been made, they are placed vertically into iron clamps directly under a row of fixed tubes, through which metal rods pass. After a little metal cap has been inserted into each of the tubes, the machine is put into operation, and a very small quantity of green nickel hydrate—the green powder—is allowed to fall into the tubes. On top of this falls, in an evenly distributed layer, some very finely divided metallic nickel scales. The metal rods descend, and under a pressure of about two thousand pounds to the square inch, forces this thin layer of nickel scales into very intimate contact with the thin layer of nickel hydrate. The rods are raised and the performance repeated, until a total of seven hundred alternate layers of nickel hydrate and flake nickel have been tamped together. Besides making intimate contact with the successive layers of nickel oxide, the layers of nickel flake make like contact with the sides of the tubes, so that when the tube is placed into a solution of potash and water, the charging current passes to these layers of flake nickel, and through the thin layers of nickel hydrate for the purpose explained.

After the tubes have been filled, they are removed from the iron clamps, another metal cap is inserted in the top of each, and the two ends are mashed flat. The tube is then placed into a machine which forces the seamless steel rings over it, equidistantly spacing them. Thirty of the tubes are then mounted on grids and firmly clamped thereto by means of retaining ears forming part of the grid.

The negative pockets are formed into two halves, open at the top. These pockets are clamped in a device, and loaded with iron oxide by machines similar to the tube-loading machines, although it is not necessary to interpose layers of metallic nickel flake, because iron oxide has lower resistance than the nickel oxide in the positive tube. The conductivity of the iron oxide is increased by mixing with it a little mercury, which is all sufficient.

Twenty-four of these pockets are placed into interstices of a steel grid and subjected to hydraulic pressure, which firmly clamps them to the grid. It also corrugates the sides of the pockets, imparting to the said sides sufficient elasticity to cause them to always adhere tightly to the iron oxide mass within.

We now come to the assembly of these positive plates and negative plates, to form a battery.

For convenience, we will mount four of our positive plates on a steel rod, the plates being equidistantly spaced by means of steel washers fitting over the rods and between the plates.

We similarly mount five negative plates on such a rod. Two nuts at the ends of each of these rods, when tightened, firmly clamp the plates.

We now sandwich the four positives and five negatives together, so that, between the negative plates, positive plates are interposed.

It becomes necessary to keep these plates from touching. We therefore place a number of hard rubber rods between them, the crevice formed between adjoining tubes of the positive plates providing a channel to hold the little rods in position.

We then fit the hard rubber ladder pieces to the edges of the plates. The cross members of these ladders have little grooves, so that the edges of the positive and negative plates fit into them, as a drawer fits into a table. This keeps the edges apart.

There must be a receptacle into which to place this combination of plates so nested together. The can, as this container is called, is made up of sheet steel, all seams of which are welded by means of the oxygen-acetylene blow pipe. The sides of the can are corrugated, to provide mechanical strength and radiating surface.

The hard rubber bottom support is placed into this steel can; the nested plates are slipped in with their hard rubber ladders in place; two thin sheets of hard rubber are slipped in between the sides of the can and the outside negative plates, and the entire unit is ready for the top.

After two hard rubber washers have been placed over the vertical pole pieces the top is put in position and likewise welded to the can. Please note that the top is welded on. Pretty good indication that we do not expect to have to get into the Edison cell again.

The fittings through which the vertical poles or terminals pass, are provided with soft rubber washers and means for expanding these soft rubber washers to form a gas-tight and liquid-tight joint between the top of the can and the poles.

Mounted on the top of the cell is an aperture through which the solution is put into the cell originally, and also through which the solution is replenished with distilled water, from time to time, as will be explained later. In the top of this aperture is a little valve, which allows the gas generated within the cell, when it is being charged, to get out of the cell, but which prevents any exterior impurities, air, etc., from getting into the cell.

After the solution, consisting of potash, distilled water and a small amount of lithium, is put into the cell, it is placed on charge and discharge, successively, for three complete cycles, after which it is ready for shipment.

The mechanical parts of the Edison battery are composed of the highest grade of steel throughout. These steel parts are heavily nickel plated, after which they are placed in retorts, hermetically sealed, and hydrogen gas fed thereto. The retorts are placed in a furnace and brought up to the proper heat, at which the nickel becomes firmly welded to the surface of the steel. This forms an impervious preserving coating of nickel for the exterior of the cell, and provides excellent electrical contact of all the parts. This process is one of the many that had to be invented and perfected for the manufacture of the Edison battery.

The cells are mounted in wooden trays with hard rubber pockets in the side slats which receive buttons on the sides of the cells and secure the cells firmly in place.

The electrical connections between cells are then completed, the positive pole of one being connected to the negative pole of the next, and so on. These connections fit over the tapered poles or terminals of the cells, and are brought into intimate contact therewith by the nuts on the ends of the poles. Therefore, to remove a cell from a tray, or to disconnect one cell from the other, it is only necessary to remove the nuts and, by means of a little jack, pull the connection off the pole. There is no sawing through connectors when disconnecting, nor lead burning necessary when setting up a battery.

Although previously mentioned in this paper, it will probably be of interest to look further into the electro-chemical action, as follows:

Starting with oxide of iron in the negative, green nickel hydrate in the positive and potassium hydrate in the solution the first charging of a cell reduces the iron oxide, to metallic iron while converting the nickel hydrate to a very high oxide of nickel, black in color. On discharge, the metallic iron goes back to iron oxide and the high nickel oxide goes to a lower oxide, but not to its original form of green nickel hydrate, and every cycle thereafter the positive charges to a high nickel oxide. Current passing in either direction (charge or discharge) decomposes the potassium hydrate of the electrolyte and the oxidation and the reduction at the electrodes are brought about by the action of its elements. An amount of potassium hydrate equal to that decomposed is always reformed at one of the electrodes by a secondary chemical reaction and consequently there is none of it lost and its density remains constant.

The eventual results of charging therefore is a transference of oxygen from the iron to the nickel electrode and that of discharging is a transference back again. This is why the Edison battery is sometimes called an "oxygen-lift" cell.

When both electrodes become fully charged the elements of the decomposed potassium hydrate can no longer act on them, and instead they re-act to produce hydrogen and oxygen, the elements of water which are given off as gas.

Nickel flakes in the positive and mercury in the negative do not take part in the chemical reaction, but are used solely to bring the particles of active material into good electrical contact with the conducting support.

The electrical efficiency of an Edison battery will all run about the same per cent and we will use the A-Four Type 150 ampere hour battery for illustration, and I will give you the complete data on this cell.

The weight of the cell is 13.5 lb. The ampere hour capacity is, as I have stated, 150 ampere hours when the cell is first put into use, and the normal actual output from a seven-hour charge is 168 ampere hours. The maximum output on overcharge from this cell is 190 amps. This cell is charged under normal charging conditions 7 hours at 30 ampere hours, and the normal discharge rate is figured five hours.

The watt hour capacity of this cell is 180. The normal actual output from a seven hour charge is 202 watts, and the maximum output from overcharge is 228 watts.

The rated capacity per pound in watt hours is 13.3; the normal output per pound from the 7 hour charge is 15.0. The maximum output per pound is 16.9.

The discharge rates of this type cell is 30 amperes. The maximum rate for intermittent discharge is 180 amperes. The watt equivalent of normal rate is 36. The watt equivalent of maximum ampere rate is 133.

The average voltage, discharging at the 5 hour rate, is 1.20. Discharging at 1/5 normal rate, the voltage rises to 1.28. While discharging at five times the normal rate, which is one hour, the voltage is lowered to .84.

The internal resistance of the Edison battery has long been the bone of contention among electrical engineers. The mean effective internal resistance of the A-Four Type is .003.

The normal ampere hour efficiency of all of the A-Type cells is 80 per cent. The normal watt hour efficiency is 60 per cent.

In reference to installation of Edison batteries in Southern California, I wish to cite one instance in particular of a set of 96 cells A-8 300 ampere hours, which are used by the Southern California Edison Company at their Long Beach steam plant for the operation of remote control oil switches. These were put in service August 11, 1911, and have been floated continuously on the line since that date, with the exception of eighteen hours when batteries were discharged and the solution renewed in them. When the batteries were discharged after being on the line two years and nine months, they showed an actual ampere hour discharge of 330 amperes.

I also may state that this company has 21 electric vehicles, all equipped with Edison batteries, some of them having been in use nearly four years, and all of them giving the best of continuous service.

Another installation is a set of 60 cells of A-6 225 amperes, which were shipped to Los Angeles, about six years ago, and were used in a one ton Lansden hotel bus owned by the King Edward Hotel. This bus was run continuously for over five years, and was in service approximately 18 hours per day. The batteries recently were removed and put in another chassis owned by Walter E. Smith Company and are now used in grocery deliveries. As this is the oldest set that we have any record of here in

California, it only goes to show the long life the batteries will stand up to with any reasonable care and attention.

The Edison Storage battery for train lighting consists of 25 cells of the A-8-H Type for 30 volt axle generator system, which system is the most generally used in the United States. This standard train-lighting set only weighs 890 pounds, as compared with about 3000 lb. for the same capacity of lead batteries, and requires only about two-thirds of the space.

The Pennsylvania railroad has in actual use about 17,000 of the A-18-H Type batteries and 500 more on order.

The Edison Storage Battery can be put on charge for five times its normal rate for a period of five minutes; four times its normal rate for fifteen minutes, three times its normal rate for thirty minutes and twice its normal rate for one hour. It can also be discharged at five times its normal rate or the cell or series of cells can be short-circuited without any injury to the battery.

LEAD STORAGE BATTERY.

BY I. R. SOLOMON.

History: The electrical industries today are enabled to practically employ the lead storage battery as a direct result of the experiments of two scientists, one by surname of Plante and the other by surname of Faure. Over forty years ago Plante discovered that solid lead plates immersed in an electrolyte of diluted sulphuric acid would undergo a chemical change when a direct current of electricity was allowed to pass for a given time. The plate connected to the positive pole would become a dark chocolate color, and the plate connected to the negative pole would become distinctly grey and spongy in appearance. After disconnecting the outside sources of electricity Plante found that an electrical current could be obtained in an opposite direction from the lead couple immersed in the diluted sulphuric acid.

Faure later on discovered that the same results as obtained by Plante could be obtained if lead grids were filled with lead oxide.

Theory: The lead storage battery is composed of a number of lead storage cells, connected in series or multiple. The individual cell is practically a primary cell, wherein the charge is accomplished by the application of direct current instead of a manual application of chemical charges as in the ordinary wet or dry primary cell, due to the fact that every metallic element in respective electrolytes has a certain electrochemical equivalent. The elements in a lead storage cell, namely lead peroxide and spongy lead in an electrolyte of dilute sulphuric acid, will give an electro-motive force of two volts on open circuit. Given a lead storage cell of two lead plates immersed in dilute sulphuric acid, a current of electricity can be obtained due to simple voltaic action, but the current will be dissipated in a very short time through polarization. If a direct current from an outside source be applied for a long period, the plate connected to the positive pole will become peroxidized, while the plate connected to the negative pole becomes spongy lead, and the density of the electrolyte rises until a point of saturation is reached, de-

termined by the voltage of the cell not rising after continued charges. A lead storage cell is then considered fully charged. Upon connecting the terminal of the charged cell to a circuit of ohmic resistance, an electric current opposite in direction to the charging current is obtained. This current is direct in character. The cell elements undergo a chemical change to the extent that the oxide on the positive plate combines with the hydrogen of the sulphuric acid, decreasing the density of the electrolyte on account of water formation, and the SO_3 in the sulphuric acid electrolyte forms a sulphate on both positive and negative plates, until such a point is reached that the cell voltage drops suddenly, indicating that both plates have reached an equal potential difference, when the cell is considered discharged. The formation of lead sulphate, which is white substance, is such that having no conductivity, affords a measure relative to the limit of discharge. This measure is given as 1.7 volts as the limiting discharge point for the safe operation of a lead storage cell. Furthermore uneven formations of lead sulphate upon the plates causes uneven action and reaction upon the plates, resulting in the buckling and cracking of the plates and shortening the life of the plates.

Manufacture of Plates: Plates for storage battery cells are either of the Plante or pasted type. Inasmuch as the unit of rating of a storage battery is the ampere hour, the size of plate for a given capacity is thus determined. Practical experience has determined that 1.4 oz. of active material is necessary per plate to obtain a discharge capacity of one ampere hour. The standard Plante plates are principally manufactured in this country by two processes. The Electric Storage Battery Company of Philadelphia employ what is known as a Manchester plate, made up of an antimony grid with corrugated lead ribbon rolled into a close spiral and hydraulically pressed into the circular openings in the antimony plate. The Gould Storage Battery Company in its factory at Depew, New York, run molten lead into calendared plate sheets, then stamp out a plate of selected size, then spin the surface in oil, dry out the oil, leaving a clean spun surface ready for formation into a positive or negative plate.

The process of forming of the Manchester and spun plates, is one of chemical or electrochemical formation. The Manchester formation process is usually electrochemical in a dilute sulphuric acid electrolyte, while the spun plate is principally chemical in nitric acid.

The manufacture of the pasted type of plates is accomplished by manually or mechanically applying litharge to a lead antimony grid, and forming electrochemically. In the experience of the speaker it has been found that with pasted type of plates, a grid with excess antimony does not have the life of one with a limited amount of antimony. Another feature which is of importance in pasted plates is that the paste should have the proper moisture within it before being applied to the grid.

The Electric Storage Battery Company manufacture a pasted type of plate which is practically devoid of metallic grid. This type has vertical helical rubber tubes with the active material loosely packed

therein. The reason for using this plate is to obtain capacity, and it is possible to do this with this type because the active material is almost entirely loose in the helical rubber containers.

Another feature of pasted plates to accomplish longer life is the hardening of the plate. In this process the Gould Storage Battery Company has been exclusive in a secret process.

Installation of stationary types: Stationary types are usually installed in a battery room especially adapted for the purposes. This room is so constructed that the floors are usually of asphalt, with the walls asphalt painted. Ventilation is usually provided under a forced draft system accomplished by the use of a motor driven exhaust fan of a size depending upon the battery capacity and the room volume. Battery racks usually of two tiers, wood construction heavily creosoted or asphalt painted, are set up so that ample room is allowed for access for individual cell inspection.

The plates for the cells are usually shipped with positive and negative groups already assembled, it being modern practice to have an odd number of plates per cell, making one more negative plate per negative group, to obtain more capacity from the positive group. Connection between cells is accomplished by leaded bolts joining the strap posts in series that is positive group strap post lug of one cell to the negative group strap post lug of one cell. Connection from cell of one tier to that of another tier is done by leaded copper bus bars, or by leaded cables. Connections from battery or individual cells to the battery switchboard are made by sweating a lead covered cable into the plate strap lug, so as not to expose any copper and leading the cable into conduits or hanging on insulators, with a run to the switchboard.

In large stationary battery equipments, the plates are set into electrolyte in lead lined wood tanks, on glass insulators. In medium size stationary equipment the plates are set in electrolyte in glass jars set in sand trays which set on glass insulators, which set on the running board of the rack tier.

In assembling the plates into the lead-lined tanks or glass jars, the plates are first placed, then the rubber or wood separators are inserted between the plates and the electrolyte poured in, and allowed to stand for about 15 hours before a developing charge is applied.

In stationary practice the separators used are either of vertical ribbed rubber or bass wood placed into slotted dowels.

Installation of portable types: These types are those as usually used for automobile service, and are of the pasted type of plates. The plates are burned into straps making individual positive and negative groups and then 1/64 hard rubber sheets and ribbed bass or cypress wood separators placed between plates and the cell element then placed into a rubber jar, electrolyte poured in, allowed to stand for about 15 hours, then developing charge applied, cover sealed on, and cells mounted in hard wood trays, asphalt painted. The battery used for portable work requires an experienced lead burner. Lead burning is accomplished by the use of a clean oxy hydrogen flame. The hydrogen gas is made by the use of a specially adapted

hydrogen generator. The oxygen is obtained from a receiver containing air under pressure.

Putting a battery into service and tests required: Practically the same procedure is necessary with Plante and pasted types of plates for the action is the same. With the plates and separators assembled in the jar, the electrolyte is then poured in after a test is made with a hydrometer to ascertain if the gravity is correct. In Plante cells the gravity of the acid is worked at a lower value than with pasted type cells because in the former ten pounds of acid per 100 ampere hours at the 8-hour rating is used, while in the latter or pasted type only about four pounds per 100 ampere hours are used. After allowing the plates to pickle in the electrolyte for about 15 hours, the developing charge of electricity is applied. This charge must equal six times and some times more, the eight hour ampere rating of the cell. If kept on without interruption, six times the rated capacity will be sufficient. To ascertain if the cell is fully developed, the following tests are made:

Gravity: A hydrometer is used to ascertain if the electrolyte gravity has reached a value of 1210 with Plante types and 1275 with pasted types.

Voltage: On closed circuit on charge the voltmeter should read 2.50 and stop rising with continued charge.

Cadmium: A round stick of cadmium covered with perforated rubber tubing is placed in the electrolyte. One end of cadmium is connected to the positive of the volt meter. The other pole of voltmeter is connected to a pointed phosphor bronze solid wire of about No. 4 gauge. When a cell is fully charged with cell voltage at 2.5, voltage between negative plate and cadmium should be from .16 to .2 volt.

Before placing the battery into service it should be discharged until reversal is reached and then placed immediately on charge and brought to capacity.

Discharge conditions: A cell should not be discharged below 1.7 volt because injurious sulphation takes place resulting in buckling. A cell is discharged when voltage is 1.7, electrolyte gravity about 1.144 in Plante type, and 1.147 in pasted type, and cadmium voltage is .25 in opposite directions to charge test.

Efficiency: The efficiency of a battery depends on the time elapsed from finished charge to start of discharge. In batteries where charge and discharge change rapidly, an efficiency of 90 to 91½ per cent can be reached. Where a long continuous charge is followed by a long continuous discharge the efficiency varies from 76 to 81 per cent.

Temperature: A battery should not be worked at a high temperature. Temperatures above 105 Fahrenheit are dangerous, and if reached the battery should at once be taken out of service and an inspection made to ascertain the cause. High temperatures on charge are due either to too high a charging rate or short circuited plates. High temperatures on discharge result from plate short circuits or from overloading.

Charging: When the rate is not known, allow six amperes per square foot of positive plate surface, and cut the rate down if the cell temperature rises 25 degrees Fahrenheit above starting temperature,

allowing for room temperature rise. Usually the manufacturers furnish the charging rates with every type of lead battery. Good practice based on a 1000 ampere hour cell for eight hours, would be for charging as follows:

250 Amps. for 1 hour.
200 Amps. for 1 hour.
150 Amps. for 3 hours.
75 Amps. for 1 hour.
25 Amps. for 2 hours.

For rapid charging:

40 per cent of total for 1st hour.
25 per cent of total for 2d hour.
20 per cent of total for 3d hour.
10 per cent of total for 4th hour.

For quick charging:

50 per cent for 1st hour.
33 1/3 per cent for 2d hour.
16 2/3 per cent for 3d hour.

A good rule to follow is cut down the rate as soon as the cell gases freely.

Evaporation of electrolyte: There is always evaporation of electrolyte in a cell undergoing cycles of charge and discharge and the same should be replaced by distilled water, during charging. This is called flushing. The plates of a cell should be covered with electrolyte so that there is 1/2 inch of electrolyte above the tops of the plates at all times. An exposed plate will sulphate.

Taking a battery out of service: A battery should be given a full charge and then an overcharge, then the battery is discharged to 1.7 volts per cell and electrolyte drawn off and distilled water added in its place. Then each cell is discharged to zero volts. The water is drawn off, plates washed by flushing and then plates can stand until wanted for further service.

Application of lead storage batteries:

Standby service in central stations.

Voltage regulation on D. C. distribution lines.

To carry peak loads of central stations.

Voltage regulation in isolated building plants.

To carry load of isolated plant, when plant is shut down for the night.

To furnish country places with power where such places are off the line of central stations.

To furnish current for talking circuits in telephone service.

To furnish current for signal work.

To light trains in connection with a generator system.

To operate submarine torpedo boats.

For ignition starting and lighting on gas cars.

To propel electric pleasure and commercial vehicles.

To regulate long distance transmission lines.

Electro-chemical products are reported by the thirteenth census to be made in thirty-four establishments in the United States. The following table shows the 1909 production and values:

	Number of establishments reporting.	Quantity, tons.	Value.
Abrasives and electrodes	4	.....	1,415,799
All other	11	.....	2,953,649
Calcium carbide	4	60,973	\$2,984,001
Caustic soda	5	19,428	1,032,647
Chlorates	5	5,785	904,550
Hypochlorites	5	45,976	1,506,831
Metals and alloys	9	.....	7,653,984
Total	34	.....	\$18,451,461

"Metals and alloys," which made up 41.5 per cent of the total value, include aluminum, silicon, ferrovanadium, ferrosilicon, ferrotitanium and cuprovandium.

LOS ANGELES AQUEDUCT DISCUSSION.

(Following is a letter addressed to the Oregon Society of Engineers regarding Mr. Chas. E. Warner's paper criticizing the Los Angeles Aqueduct (published in the Journal October 24, 1914). The Society refused to take any action on the letter The Editor.)

The systematic campaign to enlighten the public of the Northwest on the failure of the Los Angeles Aqueduct, is not inspired by any philanthropist motives, believe me. We might pass this effort on the part of our friends to save the people of other cities from the unpardonable sin of public ownership, were it not for the fact that the Los Angeles aqueduct was conceived, financed, and built entirely and wholly by engineers. When an attack is made on the aqueduct, it is a direct attack on the engineering profession.

The writer spent many years in water development in and around Los Angeles, and knows that the engineers of Southern California can get water where an Arab would die of thirst. They are the best posted water experts in the profession, and know the water situation from long experience. To say that the aqueduct was no necessity, but the result of scheming politicians, is too far from the facts, the writer knows, to be considered an unbiased opinion.

The cause for the construction of the aqueduct is very apparent to any one who has grovelled in the inverted river beds, drifted into the rocks, or stored the scanty winter rain water; any one who has done these stunts to get a few inches of water, knows the incentive and the cause of a popular cry for water in an arid land.

Water supply, and water distribution, is and always will be an engineering occupation. Financiering is not generally in his line. In the case of this great engineering feat, as in many great works of man, the engineer has had the financier to fight as well as the physical obstructions. He had in fact, to do the financiering himself. How well he succeeded in this radical departure from fixed customs can only be gathered from the facts as they now are.

The units cost is the crucial point. No matter what errors may have been committed in location, management or otherwise, the lineal foot cost of one of the longest conduits ever undertaken by man, is in actual operation, working, at a figure lower than any similar structure of present times. The writer knows nothing of the bad workmanship, malfeasance, or other mistakes said to have been made, nor does the quality of the water enter into the argument in the least. The water can be used, and the conduit does carry. That is evidence of success of the engineers. Low cost and efficiency; what more could you require? Nothing.

The water may not be the best. It may be too bad for domestic use, but it is good enough for irrigation, and incidentally for water power. There was nothing but praise from all sides for the undertaking up to the time the power possibility was urged as an asset to the city. Right there the trouble began. One hydroelectric company with an investment of ten millions, (the unit cost was not low, either) fearing the competition of the city, short-circuited the city bond sales in no time. They are still fighting public ownership. Whatever the merits or demerits of public

ownership may be, the public will finally determine. The point I wish to make is this: the reflection cast on the ability and integrity of engineers of the aqueduct; is not this a reflection on the profession? Are we not allowing ourselves to be exploited for the benefit of bond dealers in their campaign against public ownership? If you feel the same as the writer, you will send a note of congratulation to the men who are placing engineering where it belongs in the proper scheme of achievements.

Our profession is certainly in need of such men as those of the Los Angeles aqueduct. Perhaps the time for public ownership has arrived, and with it, the demise of the greatest possible mortgage value that can be handed to the same dear public to pay interest upon.

It is quite probable that the time has come when the public may see the difference between mortgage bonds based on municipal indorsements, and those bearing burdens of inflated values of monopolies. Who knows? With the new currency law, public ownership is more possible than ever. Should the engineer lend himself and his profession to thwart popular opinion? Should he as an individual or a paid servant, use the work of his fellows, to belittle and besmirch them in his zeal to shape public opinion? Is it better for the engineer to be a recognized man of affairs, or the faithful slave of a corporation? All these questions you must answer when you countenance the remarks designed to shape public opinion against public ownership.

Our aim is to add dignity and stability to our vocation; to promote our own interest by honest means, to our rightful place in society.

H. J. STOCKER.

Gresham, Ore.

LETTER TO THE EDITOR.

Los Angeles Aqueduct Mistakes.

Sir:—In your issue December 12th, Mr. Homberger of San Francisco expresses some interesting and to my mind, correct conclusions concerning certain difficulties of securing improved public service through municipal operation.

In his reference, however, to the Los Angeles aqueduct, he gives me the impression that he believes an important cause of the Los Angeles aqueduct failure to have been the opposition of power companies to its hydroelectric features.

As Mr. Homberger points out—the hydroelectric development was an afterthought. It was clearly, therefore, not the indirect cause of the following:

1. The planning of a 240 mile aqueduct, for a city of then approximately 160,000 people which already owned a supply of superior water sufficient for 1,000,000 people.

2. The unlawful seizure of the most important reservoir site by a private individual without protest from the city officials, thus making necessary the abandonment of annual storage and greatly reducing the dependable supply.

3. The adulteration of the cement with a clay which the adequate officials called tufa, thereby producing a concrete which did not harden under the

conditions to which it was subjected and made serious breaks and expensive repairs a certainty.

Also it is beyond comprehension that any enemy of municipal operation could be capable of such Machiavellian intrigue as to cause the aqueduct management to adopt a system of accounting under which auditing was practically impossible; to lose 11 caterpillar traction engines and 12 trail wagons (\$47,600 worth of heavy machinery) so effectively as to leave no record and no trace; or to adopt an inhuman plan of feeding, medical supervision and claims adjustment.

There are many other proofs that the aqueduct outrage and its subsequent failure were not due to any extraneous influences whatsoever. In fact, the best friends of honest municipal endeavor in Southern California join in condemning it, not only for the wrongs perpetrated on Los Angeles taxpayers and workmen but for its influence in discrediting honest efforts toward improvement of municipal conditions.

Very respectfully,

CHARLES E. WARNER.

MUNICIPAL OWNERSHIP AT SEATTLE.

Considerable space has been devoted by the daily papers of Seattle to the leaks which have developed in the new Cedar River dam. It is stated that the dam which was built by the city for its lighting department at Cedar Lake for the purpose of raising the level of the lake and increasing the power development for the city lighting plant at that point, has cost the taxpayers over one and one-half millions of dollars and was completed the first of last November. The dam is of concrete construction, about 200 ft. high and is built across the canyon two miles below the present crib dam, from which point penstocks take the water to the power house. The new dam was intended to raise the lake about 45 ft. above the present level of the old dam.

About two years ago, after the city had done considerable work in clearing the damsite, there was a great deal of discussion concerning the character of the north bank of the canyon and its ability to hold water. This bank was of gravel, formed through glacial action forcing the gravel up into a bank and creating the present river bed of the Cedar River, and dividing that river bed from the Snoqualmie water shed. Prominent engineers contended that the bank would not hold water, and as a result of this discussion, the city council appropriated five thousand dollars to pay three prominent hydraulic engineers to make an examination. In due course their report was submitted to the city authorities. The report strongly recommended further investigation into the character of the bank, and that test holes be sunk, and other steps taken to show whether or not the bank would hold water. They reported that in their opinion there was grave doubt as to the bank being of a character that would retain the water after the dam was built and water allowed to flow in back of the structure. The report was filed away and the mayor, city council and lighting department decided that there was no necessity for further investigation and ordered contract let for completion of the dam.

The gates were closed at the dam and the basin allowed to fill up. After the level of the water had reached a point 34 feet below the present level of the lake back of the new dam, it was discovered that the water no longer continued to rise, although the entire drainage from the Cedar Lake basin was coming into the basin, and that it was seeping away at the same rate that it was flowing in. The leakage continued to increase until the basin is now discharging more water than is being furnished by the entire flow of the river. It now looks as though the dam would be utterly useless, and the only remedy seems to be to build a concrete wall for two or three miles along the north bank of the canyon. The cost of such a wall would of course be tremendous.

Report of Municipal Railway.

The accompanying tabulation showing a loss of nearly \$6000 a month for the first six months' operation of the municipal railway does not include any charge for accounting or superintendence. This work has been done by the public utilities department and nothing charged up against the municipal railways for the service. No fire, damage, personal injury or employes' injury insurance fund has been provided. The services of the legal department have been furnished continuously to the railway department without charge as has also the services of the comptroller's and treasurer's departments. The time spent by employes of all of these departments represents a considerable sum of money. Where new employes are

SEATTLE MUNICIPAL STREET RAILWAY.

Operating Expenses and Earnings From June to November 30, 1914.

Operating Expenses.

	June.		July.		August.	
	"A."	"C."	"A."	"C."	"A."	"C."
Way and Struct.....	\$ 137.60	\$ 10.82	\$ 67.78	\$ 35.44	\$ 78.00	\$ 83.76
Equipment	75.11	.....	129.05	66.30	105.02	35.68
Power	955.00	813.56	993.80	825.70	972.41	828.50
P. Cond. and Mtrmn.....	985.59	954.54	993.76	861.04	991.37	855.23
F. Cond. and Mtrmn.....	.....	17.81	.....	46.31	.....	50.25
Carhouse Emp.....	425.25	18.29	279.25	61.18	279.19	65.06
Other Trans. Emp.....	62.50	134.94	62.50	132.76	62.50	117.76
Other Trans. Exp.....	12.68	8.55	38.09	7.50	32.72	57.61
General and miscellaneous.....	3.15	505.40	9.65	470.20	.....	465.00
Total	\$2,657.18	\$2,463.91	\$2,585.49	\$2,521.19	\$2,547.56	\$2,514.24
	September.		October.		November.	
Way and Struct.....	\$ 81.38	\$ 169.80	\$ 31.81	\$ 293.47	.....	.....
Equipment	60.57	146.72	170.70	43.90	.....	.....
Power	6.15	.....	12.20	.....	.....	.....
P. Cond. and Mtrmn.....	929.00	803.00	670.00	570.00	.....	.....
F. Cond. and Mtrmn.....	919.34	793.69	900.98	780.06	.....	.....
Carhouse Emp.....	270.94	84.01	280.51	61.13	.....	.....
Other Trans. Emp.....	31.25	145.25	96.20	91.13	.....	.....
Other Trans. Exp.....	58.37	26.57	35.04	124.25	.....	.....
General and miscellaneous.....	.....	500.06	.....	6.14	.....	.....
Total	\$2,357.00	\$2,722.27	\$2,197.44	\$2,478.96	\$2,804.82	\$3,146.49

Earnings.

	June.		July.		August.	
Passenger revenue	\$1,346.02	\$1,886.13	\$1,482.54	\$2,065.87	\$1,436.93	\$1,774.24
Freight revenue .....	.....	25.00	.....	107.15	.....	120.05
Miscellaneous revenue.....	466.67	8.33	481.67	11.71	481.67	8.33
Total	\$1,812.69	\$1,919.46	\$1,964.21	\$2,184.73	\$1,918.60	\$1,902.67
	September.		October.		November.	
Passenger revenue	\$1,307.73	\$1,190.64	\$1,226.79	\$1,127.61	\$1,118.05	\$ 937.88
Freight revenue .....	.....	87.20	.....	140.80	.....	111.90
Miscellaneous revenue.....	466.67	8.33	481.67	8.33	466.67	8.33
Total	\$1,774.40	\$1,286.17	\$1,708.46	\$1,276.74	\$1,584.72	\$1,058.11
Operating expenses, Division "A," from June to November 30						\$15,049.49
Operating expenses, Division "C," from May 23 to November 30						\$15,847.06
Less book charge rental of cars, Division "A"						2,845.02
Total operating, Divisions A and C (no interest on other fixed charges)						28,051.53
Revenue, Division A, June 1 to November 30						\$10,763.08
Less book credit for car rental						2,845.02
Revenue Division A, from June 1 to November 30						7,918.06
Revenue Division C, from May 23 to November 30						9,627.88
Loss						\$10,505.59

Loss from operation to November 30, 1914.....	\$10,505.59
6 months' bond interest on \$300,000 at 4½ per cent..	6,750.00
Interest on \$75,000 borrowed from Garb. Fund and \$9,000 from G. F., at 4½ per cent.....	1,890.00
6 months' taxes on \$375,000 invest. Division "A," basis 45 per cent val.....	3,750.00
6 months' deprec. at 4 per cent on \$375,000 plant cost Division "A".....	7,500.00
6 months' int. on \$27,500 at 4½ per cent borrowed from G. F. for Division "C".....	612.00
6 months' taxes on \$150,000 inv. Division "C," basis 45 per cent valuation.....	1,500.00
6 months' deprec., 44 per cent on \$150,000 plant, account Division "C".....	3,000.00
Total loss, 6 months, "A" and "C".....	\$35,507.59

taken on and the time of old employes in these departments is given up to the work in connection with the municipal railways, their wages should be charged to the municipal railway in order that the taxpayer may be protected.

There was only one month when either Division "A" or "C" showed an excess of receipts from traffic above the bare operating expenses, exclusive of interest and other fixed charges as will be seen by the following table. Division "C" showed an excess of \$145.21 in the month of July:

	June.		July.		August.	
	"A."	"C."	"A."	"C."	"A."	"C."
Expenses	\$2,657.18	\$1,997.24	\$2,585.49	\$2,039.52	\$2,547.56	\$2,032.57
Receipts	1,316.02	1919.46	1,482.54	2,184.73	1,436.93	1,902.67
Deficit	\$1,311.16	\$ 77.78	\$1,102.95	\$ 115.21*	\$1,110.63	29.90
*Surplus.	.....	.....	.....	.....	.....	.....
	September.		October.		November.	
Expenses	\$2,357.00	\$2,255.60	\$2,197.44	\$1,997.29	\$2,804.82	\$2,679.82
Receipts	1,307.73	1,286.17	1,226.79	1,276.74	1,118.05	1,058.11
Deficit	\$1,049.27	\$ 969.43	\$ 970.69	\$ 720.55	\$1,686.77	\$1,621.71

The receipts from passenger traffic of Division "A" have fallen off from \$1482.54 in the month of July (the highest) to \$1118.05 for the month of November, and for Division "C" from \$2184.13 (the highest) to \$1058.11 for the month of November. While the operating expenses exclusive of interest and other fixed expenses have varied from \$2197.44, the lowest in any one month for Division "A," to \$2804.82, the highest, for the month of November, and for Division "C" from \$1997.24 in the month of June to \$2679.82 for the month of November. The receipts from the traffic of neither division are at present sufficient to pay the wages of motormen, conductors, carhouse and transportation employees.

Veto on Extension Bill.

Mayor Gill in his veto message accompanying the unsigned municipal light extension bill returned to the council, characterized the measure as socialistic, giving an opportunity for "certain persons to settle grudges arising from real or imaginary grievances against a private corporation." He sets forth at length what he believes to be the legitimate purpose of a municipally owned utility. The extension of the light and power system outside of the city limits to Tukwila and Foster is not within the pale of legitimacy, he says, and, if necessary, he will take issue with the council on the extension if the bill is passed over his veto.

In the closing paragraph of one of the longest veto messages Mayor Gill has ever penned he makes it clear that as long as he holds the executive's chair the department will confine its operations within the corporate limits of the city.

Mayor Gill says that the city is not properly lighted; that taxpayers in some cases have had to put in their own wire and poles to get electrical service from the city, and that the department should turn its attention to the needs of those within municipal boundaries, light up the alleys and add another penstock from the Cedar dam.

MUNICIPAL OWNERSHIP OF WATER WORKS AND SUPPLY AND OF HYDROELECTRIC POWER PLANTS.

BY E. F. SCATTERGOOD.

A contributor to the December 12th issue of the Journal of Electricity, Power & Gas, who, in the innocence of youth, has failed to penetrate or comprehend the significance of certain articles, of comparatively recent date, appearing in the Journal, appears to have reached the conviction that municipal ownership of hydroelectric power plants is absolutely without justification, and that the advisability of a city owning its own water supply and distributing works is very questionable. The completed aqueduct project and partially completed hydroelectric power works of the city of Los Angeles are cited as the basis of warning to the city of San Francisco regarding such municipal undertakings.

Three essentials to the prosperity and growth of a municipality or a community are an ample water supply at a reasonable cost, adequate transportation

at low rates, and cheap electric power of a reliable character. Where these three are combined, such growth is assured.

As bearing on the advantages of a municipally owned water supply, it should be observed that the city of Los Angeles has owned its water system for something over 12 years; that during that period the rates for water service have been but approximately one-half, or less than one-half, the average rates for such service in the cities of Oakland and San Francisco, for example, under private ownership and public regulation. At the same time the city of Los Angeles has practically rebuilt and extended its local water system and supply out of the earnings and the total outstanding liabilities, or bonds, are less than \$2,000,000, while the city of San Francisco is at this time facing an expenditure of \$35,000,000 for the purchase of the existing local water system and supply.

Ownership by the city of Los Angeles of its water supply and system has made it possible to reach out and secure a permanent and ample supply of pure water, at reasonable cost, for the future. It has become an accomplished fact through the completion of its aqueduct, leading from the Owens Valley, and the benefits resulting from such guaranteed water supply have already more than repaid the property owners for the expense to them of the undertaking. San Francisco unquestionably should realize similar benefits from the carrying out of its proposed Hetch Hetchy project.

It is true that the completion of the proposed hydroelectric power system of Los Angeles has been delayed something like two years owing to the opposition of private interests, who are unwilling to sell their existing systems to the city at a valuation made at this time by the railroad commission, or otherwise. However, the merits of municipal ownership of hydroelectric plants, as well as of a water supply, become apparent by a further comparison between conditions existing in Los Angeles and San Francisco. While in Los Angeles, as a result of the stimulating effect of municipally owned hydroelectric plants, which are as yet but partially completed, we are enjoying a $5\frac{1}{2}$ ¢ base rate for electric light service and a very much lower base rate for power service, without such a thing as a contest in the courts being mentioned, in San Francisco, where public regulation exists without municipal ownership of such power plants, they have not been successful in establishing rates anywhere near as favorable to the consumer, although they have attempted to do so; have had the benefits of comparison with the rates in Los Angeles, and, at least, should have had the benefits of the existence of abundant water power comparatively near the city.

Remembering, then, that a reliable water and power supply, at low rates, are two of the three essentials to the fullest development of a community, there appears to be no reason why the city of San Francisco which is to be congratulated upon its successful handling of the local transportation problem, should hesitate or give ear to any warning against proceeding with its proposed ownership of water works and supply and of a hydroelectric power supply.

OREGON HYDROELECTRIC CONFERENCE

The annual session of the Oregon Hydroelectric Commission was held December 12th during the Commonwealth Conference at Eugene. The chief subject for discussion was the proposal that hydroelectric power districts be established.

The meeting was called to order at 9:30 a. m. by Hon. H. B. Miller, chairman of the commission. An outline of the proposed measure, which had been prepared by John McCourt, was read by Secretary W. D. B. Dodson. The plan is to divide the state into hydroelectric districts which are to be bonded for the development of electricity from the natural water power. Each district is to be vested with the power to acquire and develop water under the plan of the Wisconsin indeterminate franchise, under the regulating jurisdiction of the railroad commission.

A paper on "Hydroelectric Problems in Oregon" was read by Charles E. Warner. W. H. Crawford presented a strong plea for the enactment of laws which will make possible the formation of hydroelectric districts. Both of these papers are published in this issue.

During the afternoon session J. L. White gave a paper on "Electricity in Rural Districts" and H. L. Vorse read a paper prepared by Dr. J. F. Watt to show the need for a district hydroelectric law. Senator L. B. Huston spoke regarding national regulation of hydroelectric power and was appointed a committee of one to draft and send a resolu-

tion to Oregon's senators in Congress to hold up the Ferris bill until certain changes could be made in it.

General discussion then held sway for two hours. Those taking part were: W. D. B. Dodson, Secretary Clyde B. Aitchison, State Utilities Commissioner C. E. Warner, Porter J. Neff, H. L. Vorse, member Hydroelectric Commission; Professor F. G. Young, Wm. H. P. Hill, Northwestern Electric Company.

As a culmination of the afternoon's discussion, a motion was made by Charles E. Warner, consulting civil engineer, that a committee of three be appointed by the chair to frame the suggestions made in the conference concerning the formation of hydroelectric districts. The committee is to work with the Oregon Commission that a proposed act may be submitted to the legislature next month. Mr. Warner's motion carried, and C. P. Bishop of Salem, S. B. Huston, State Representative-elect, of Portland, and Charles E. Warner will serve in that capacity. As a result at the next session of the legislature a bill will be presented to provide for the incorporation and organization of public utility districts to incur bonded indebtedness for the purpose of the construction of works and the acquiring of property, and to levy and collect taxes to pay the principal and interest on bonds for the carrying on of these operations and to provide for the powers, management and government of such districts.

THE HYDROELECTRIC PROBLEM IN OREGON.

BY CHARLES E. WARNER.

To many, the hydroelectric problem of Oregon seems a simple one. We have large streams with falls and rapids. Take the difference in elevation and the quantity of water, make the proper multiplication and divisions and there you are 3,000,000 horsepower. Now issue as many bonds as the people will vote, and build a few large hydroelectric plants at the expense of the taxpayers and there you are. The only practical part of the above is its termination—"There you are."

The "wonders of electricity" have a tendency to make men dream. Electricity is so intangible. It can be measured or estimated only on a basis of pure theory confirmed by the fact that the theory fits when practically applied. Electricity can not be seen and it is extremely difficult for the average person—even of the well informed—to get anything but the most hazy impression of a thing he cannot see. Therefore when high-sounding statements are made in the press or from the platform about the wonderful results obtainable through the development of large quantities of electric power, most people are inclined to fall under the spell and accept the prophesy of miracles without putting the prophet to the test of analysis.

Out here in Oregon we are especially tempted to imagine great things. The whole country is big and its features are grand and when we are told that we have 3,000,000 horsepower of undeveloped water power and that this power places the command of the industry of the world in our hands, it is easier to believe than not.

Fortunately for Oregon, many of us possess an idea of balance and are able to relate one set of figure to another and to consider that it takes more than one element to make industrial success.

Sets of figures mean very little until analyzed by men possessing practical knowledge of their application and significance.

There must be estimates and tabulations, however, as a basis of determining facts and as the public at large cannot of necessity be experts on all subjects, the only statements that impress the public are those which express striking ideas in a few words or figures.

Three million horsepower embraces a great deal in four words. In its practical significance to this generation, however, it may mean much or little according to the comparative wisdom exercised by the people of Oregon, with the consent of the U. S. Government, in considering the practical utilization of so much of that power as may economically be developed for such utilization. In this sense we may be limited to 1,000,000 horsepower, still a large figure, or we may be limited to an extremely small power over which we could not enthuse at all.

Nowhere in the world is the relation of physical and intangible values better illustrated than in this latent water power of the Pacific Northwest. For some years there has been a tendency in the United States to develop a line of thought started in those thickly populated centers of the East where almost any sort of raw material has a positive value—the line of thought which establishes physical value as the only real value of a property. There is hardly any conception so false, however, as this distortion of the relative importance of physical value. Strictly speaking there is no such thing as physical value. The coal in the ground or the tree in the forest has no value until coupled with the intangible value of men's abilities. The value of the lumber or the steel rail or the hydroelectric plant is physical plus intangible value and from the time the raw material begins to be used, that which increases its value is altogether the brain power of men applied through the labor of other men and through machinery built by men.

In New England water power is money. The home market is there for industries in which power is an important factor. Also fuel is expensive. The policy of the United States in conservation is dictated largely by Eastern men who have small conception of or interest in the water power problems of the West. It has been hoped that the able Californian who is now Secretary of the Interior will help to make Western water power development more encouraging than at present.

In any event, we face a problem in Oregon entirely opposite to that of the East. They have the home market for industrial products. We have undeveloped power. Our undeveloped water power is a basis of hope for the future, but it must have a market and there are just two ways to get

that market. We may build up a home market through pump irrigation; a more liberal system of farm credits; and a comprehensive colonization plan. We may also develop a few industries which will consume large quantities of electric power and will produce goods on a cost basis that will enable them to compete on favorable terms in the markets of the world. In either case our problem is not one of power development. It is one of careful research to find what kind or kinds of market we can develop for the power now available in quantities far ahead of present demands.

I am not here to plead for corporations. But it is a strange condition in which some electric corporations find themselves today, being between regulating officials, on one hand, who criticize them for too much development, and on the other hand, the threat of more power being developed in an already saturated market.

I am glad to see the hydroelectric commission endeavoring to find some means of extending the market for electric power. That is the most important thing that can be done.

Oregon and California have each about 3,000,000 horsepower of undeveloped water power. Washington has 5,000,000. These are government estimates. All this power is in competition with other kinds of power and with other localities. Norway develops power by a combination of government ownership and private operation at low cost. Other localities are more favored in raw materials than we are. Also we have a great deal of power developed in Oregon from sawmill refuse at a cost which puts waterpower out of competition except under the most favorable conditions. All these elements combine to add to the burden of our difficulty in making a practical application of our great power. This is the negative side of the situation, but it must be considered.

On the other hand, we have vast areas of good soil. Under much of this soil lies water at reasonable depth. In all of Oregon, irrigation has some value and pump irrigation will greatly benefit the state. There are many other farm uses of electricity which will be referred to by another speaker. I only mention this phase of the subject in a general way as a cause for optimism.

Then we have an inland seaport 100 miles from the ocean—an ideal location for gathering a variety of inland products for ocean shipment. Reaching inland from that port are about 2000 miles of river which is partly navigable and now gives water grades for railroads. All this 2000 miles will become navigable and we shall be able to assemble raw materials from British Columbia, Idaho, Washington, and Oregon to build up at Portland one of the great manufacturing centers of the West. This will take time but it is coming and the rapidity of its approach will depend upon the wisdom and industry of the people of Oregon. We ought to make up our minds to bend every effort toward a consolidation of government and private enterprise in solving this hydroelectric problem. We ought to get every one in Oregon working together and the more help, financial and otherwise, we can get from outside the state on a fair basis to all concerned, the better. We want all the help we can get on fair terms.

THE DEVELOPMENT OF STATE BUSINESS.

BY W. H. CRAWFORD.

The state of Oregon is just a big business institution. It is in a corporation in which we are all stockholders. It is an enterprise owning about 100,000 square miles of mountains, valleys, plains, desert country; rivers, power streams, coast line, forests and fertile fields, less a large area held as Forest Reserve. The stockholders are 750,000 fortunate human beings. Broadly speaking, the business of the state is to make its stockholders comfortable, happy and prosperous. We get no cash dividends on our stock, in fact we pay assessments all the time. Hence our profit must appear, indirectly in our special field of endeavor.

There are two broad divisions in the analysis of every business enterprise; the internal construction and management of the company itself, and the external relationship of the company with the outside world. Or we might say Production and Sales. Both departments are very important. If production is faulty there will soon be no sales, and if sales are neglected the company will fail, no matter how perfectly organized the production may be.

In the business of state, we find the same weakness that prevails in corporation and individual life. Usually, more attention is paid to the internal productive end, than to the external market and of the business. The part that is nearest to us receives most attention. The state is almost exclusively concentrated on the production and management of its business, at the expense usually of the sales end. We have laws, commissions and institutions all designed to make smooth the internal operations of our big corporation, but how much business getting machinery?

A very natural question at this point might be "What has the state to sell?" If we agree that the dividends are to be comfort, happiness and prosperity to the stockholders, then anything that the state can do in the way of selling, or serving, or giving that will pile up dividends for the stockholders, is the state's business.

Oregon has a railroad commission handling utility matters. It is designed to insure to the people, and to investors, fair play, but it cannot help to push business. It acts as a court of justice, in matters of dispute that have no standing in regular courts, because the law has not yet made crimes of those particular disputes. When luxuries become necessities in the march of civilization, then we are inclined to handle them in order to accomplish the greatest good for the greatest number.

Similar commissions in other states have more or less power, but none that reach beyond the internal, managerial end of the state's business. Attempts have been made from time to time to push business in an official way. The Georgia Chamber of Commerce has a committee on water power development whose purpose is to enlighten the farmer on uses of electricity; to reach out after manufacturers and to initiate useful legislation along these lines. Illinois has 100,000 h. p. water shed on the Illinois River which it will market if possible. The Sanitary District of Chicago has 28,000 h.p. developed (48,000 h.p. still undeveloped) which it sells to the city of Chicago at cost. New York State has 1,250,000 h.p. of undeveloped water power which it is trying to market, bills having been before the legislature since 1911 proposing to create a commission with power to purchase, develop and sell electric current to municipalities or districts.

In Ontario, Canada, a measure was passed in 1906 creating the Hydroelectric Power Commission. This commission has the function of business getting. It can buy or generate power and sell it to municipalities or districts or to individuals. It started in by purchasing current in large lots from the Ontario Power Company, at Niagara Falls for \$9 per h.p. per year. It delivered this in smaller lots, over its own lines, to the doors of various cities in Ontario for prices ranging from \$18 per h.p. per year, and upwards, depending on the cost of delivery. Today this commission serves over 2,000,000 people with 50,000 h.p. The cost of service to the community has been reduced about one-half of what it was on old basis and the demand increased so that today the current consumption per capita is three times greater in Ontario than in New York State, just across the St. Lawrence River.

Right here let us turn our attention for a moment to the United States, and make a comparison between the East and West. Suppose we draw a line straight up and down on the eastern border of Montana and Arizona. This would cut the United States in two, with $\frac{1}{4}$ of our territory lying west of

the line and $\frac{3}{4}$ lying east of it. Six per cent of our population would be west of the line and 94 per cent east.

The electric current consumption per capita per annum West is 527 kw. hr. and East 99 kw. hr. In other words, while Ontario exceeds New York State, three to one (with similar conditions and equal opportunities) the Western quarter of the United States exceeds the Eastern three-quarters by over 5 to 1. This cannot be used to prove anything, without further analysis, excepting the fact that heavy investments have been made in our Western country regardless of the market.

The investment per capita in power generation and transmission machinery is \$7.50 in the Western quarter and \$3.00 in the Eastern three-quarters, Oregon having about twice \$7.50 per capita.

The Ontario Commission was a bold step and apparently a wise one as it seems to have proved out its practice, although we cannot say that this procedure will fit every case.

Local conditions must always be considered. In Oregon we have a great surplus of power already developed and on the market waiting for purchaser. This condition is almost uniform throughout the state. There are of course a few places where people want to buy current and cannot get it. (We have an easy remedy for this). There are also hundreds of alluring water falls that have not been developed and seem to tempt us with their song of cheaper power. Then we have that golden opportunity for power development in connection with sawmills as at Marshfield, Astoria and Springfield.

Now for the question: In this big business corporation of Oregon, what can we do at our next stockholders' meeting with reference to our next session of the legislature, or directors' meeting if it carries out the simile any better, to insure bigger dividends? I have some suggestions to make that are very temperate, very modest, but very necessary. They relate both to the productive and to the market end of our business.

First: I want the powers of our able railroad commission broadened to cover municipal utilities as well as private corporations. Municipal utilities must be under regulation if the work of the commission is to be efficient.

Second: I want to make it possible for rural districts and municipalities to combine, or for districts alone to organize for the production, purchase, transmission and sale of electric current, where it is impossible to get proper service from other means at hand. And I want these districts to get their permission to organize, and to operate from the railroad commission, and to be governed by it, just as private corporations do now.

Third: I want the private corporations who have invested their money here in the western part of the United States to the extent of \$7.50 per capita, and in Oregon to an amount about twice as great, to prosper. Their electrical development is far in excess of present requirements in most places, hence their load curve poor and revenue unsatisfactory. We should help them build up their load curve; to find a market for their product, so that further market can be found for further product. Their success is our success, remembering that we now have a court of disputes in the railroad commission, if we should be dissatisfied with anything.

The commission (if properly empowered) will protect us from injustice and will protect one investor against the evil acts of another investor. As stockholders in the great business of Oregon, we will enjoy better dividends if we recognize the advantage of helping along the market end of our enterprise.

Our wonderful water falls are far better unharnessed, than that good money be spent to make them work before we have a proper market to absorb the product. This folly would place 3 h.p. where 2 h.p. are now offered to do the work of one.

Under these conditions somebody will suffer and none

can profit long. So my third proposition is to develop our market, to educate the individual consumer, before we spend any more money on new plants, and before we let any one else spend more money.

When you hear the suggestion I would make, showing how the state can help the market end of the business, please remember that private corporations are doing this all the time. But they have found that when they go to the individual in their desire to educate him and increase the use of current, the individual has a little problem of his own.

My first and second suggestions are up for immediate action. These are all following suggestions and predicated on the broad principle that when the state as a whole is on a highly efficient sales basis, the coming of new industries and the further development of our power sites will follow as a natural consequence, in the right way.

PANAMA-PACIFIC A. I. E. E. CONVENTION.

Mr. H. A. Lardner, who was chairman of the Pacific Coast committee of arrangements for the postponed International Electrical Congress, has received word from Secretary F. L. Hutchinson of the American Institute of Electrical Engineers that at a recent meeting of the Board of Directors of the Institute it was decided that the San Francisco convention of the Institute next year should be held in September, during the week originally decided upon for the International Electrical Congress; or, in other words, during the week immediately preceding the International Engineering Congress.

The decision was reached principally on account of the fact that the Institute is joint host with the other national engineering societies in arranging for the International Engineering Congress, and also because we have learned that the American Society of Civil Engineers is to hold its annual convention in San Francisco during the week preceding the Congress, that the American Institute of Mining Engineers is to hold its midsummer meeting either during that week, or during the week of the Congress, and also that the American Society of Mechanical Engineers will in all probability hold a special meeting in San Francisco approximately at the same time.

OREGON IRRIGATION CONGRESS.

The Oregon Irrigation Congress will be held at Imperial Hotel, Portland, Oregon, January 7, 8, and 9, 1915. This session will open with an address of welcome by Mayor H. R. Albee, after which there will be an informal discussion on business. No papers to be read. Only oral speeches which will be limited as regards time. All discussion to be oral also. Formal papers may be submitted in the form of reports to be used in the printed proceedings.

In the evening a banquet will be given by Portland Commercial Club to the delegates. The speakers will be Governor-Elect James W. Whitcomb, Hon. Duncan Marshall, Minister of Agriculture, province of Alberta, Edmonton; O. Laugaard, Project Engineer, Tumalo Irrigation Project. "Report of Work Accomplished by the Oregon Irrigation Congress." Attorney General of Oregon (Elect) Geo. M. Brown, short talk; M. J. Kerr, President O. A. C.; E. G. Hopson, U. S. Reclamation Service; E. L. Thompson, (Hartman & Thompson Bank), Chairman Commercial Club Irrigation Congress.

On January 8th in the morning, Hon. Duncan Marshall will give an address, followed by discussion from delegates, and in the afternoon the report on legislative work of the Irrigation Congress will be read by J. T. Hinkle, Ex. Secretary Irrigation Congress. A brief address will be made by Geo. M. Brown.

On January 9th there will be addresses by C. L. Smith, agriculturist of the O. W. P. & N. Co.; Geo. T. Cockran, Water Division No. 3 Superintendent, La Grande, Oregon, and Herbert D. Newell, Project Engineer, Hermiston, Oregon.

JOURNAL OF ELECTRICITY

POWER AND GAS

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Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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Before turning the page to the year to come it is of interest and value to look over the page of the year which is now rapidly drawing to a close. Most prominent is the black picture of war, reaching out with greedy fingers to draw all civilization down into the maelstrom of destruction. While we of the West are far from the scenes of battle we sympathize with the misfortunes of others and rejoice in our own comparative peace and security.

Yet the war, by tightening the money market, has had a depressing effect upon all engineering construction. This has been reflected by a decrease in new work and has resulted in laying off many able men.

The financial stringency has been intensified by the hostile attitude of the government toward business. The gloomy prophesies of the effects of the conservation policy have been verified. Men hesitate to invest in hydroelectric securities made insecure by governmental threat. The immediate effect, also, of some of the public service commissions, has been to inspire doubt as to their ultimate intentions. Governmental competition in such public service as communication or power generation, does not stimulate confidence in private holdings.

Without money, engineering ability and opportunity are of no avail. As a consequence, most of the engineers of the West have been marking time during the past year. Many have had a chance to finish some long cherished plan and a few have had opportunity to rest, something not possible in the feverish activity of the previous decade.

This somber picture of the past makes the future appear all the brighter by contrast. Each element which contributed to past weakness will prove of future strength. The inevitable reaction of the European war will be to boom American business. President Wilson gives assurance that business need have no further fears as to what Washington may do. Added stability has been given to public utility issues which have been passed by the commissions. Even timid capital is beginning to realize that cause for alarm is passing and business men are now saying "business is better."

As we turn our eyes to the future every prospect is bright for renewed Western prosperity. Thousands upon thousands of visitors will view the wonders of the West for the first time while on their way to and from the Panama-Pacific International Exposition. Interest will be aroused in the opportunities for development of our great natural resources. Renewed interest is being taken in mining, fisheries are declaring big dividends, the farmer has received good prices for large crops, ample water is already assured for irrigation and hydroelectric operation, and every substantial reason exists for optimism.

Nothing can be accomplished by regretting that 1914, like the rushing waters hurrying to the ocean of oblivion, was not more efficiently utilized in driving the wheels of progress. The old year has already been made obsolescent by the promise of the new. Heed the lessons learned and apply the experience gained in the design of the new year.

Turning the Page

These mutations of time which we commemorate are but arbitrary measurements of duration. There was no old year and will be no new in the infinite stream with which our finite minds are momentarily in contact. This new year will be like other years with its complement of success and failure, hope and disappointment, joy and sorrow. Only let it be remembered that the discovery of the future is based upon the records of the past and every Journal reader will enjoy that "Happy New Year" which it is our pleasure to extend at this season.

Although attention has been called many times in these columns to the injustice and inequality of the

The Evils of Price Cutting

Supreme Court decision which forbade a manufacturer from naming the price at which his product should be sold to the consumer.

time has not yet provided a relief, nor has it softened the hardship. Its effect in the electrical business is particularly demoralizing and is largely responsible for the lack of harmony between the central station and the dealer. The central station does not know at what time it will need the friendship of the electrical contractor and dealer as an advocate at the bar of public opinion, nor does it realize how the practice of cutting prices on electrical devices is estranging the dealer. To legalize price maintenance would at least remove the temptation to cut prices.

Price maintenance does not mean price-fixing, nor does it strengthen monopoly. It raises competition from a cut-throat struggle of price against price to the higher level of quality against quality and service against service. It preserves for the manufacturer the market he has created by legitimate sales effort, it protects the retailer against unfair competition of other retailers and gives the consumer standard quality at standard prices. The benefits of price maintenance may be emphasized by considering the evils of price cutting.

Price cutting pre-supposes that a fair standard of quality and of price has been set by extensive advertising, as otherwise there would be no inducement to cut the price. It causes doubt in the purchaser's mind as to the value of the article; it injures the name of the article and its maker; it lessens the demand, and if not checked finally ruins the market. A cut price is not a leader but a mis-leader.

We all realize the necessity for standards. We all believe that confidence and service are the basis of trade. We know that success is the science of being believed in. Yet whenever we sell or buy an article at a cut price, except under extraordinary circumstances, we are tearing down the foundations of successful merchandizing, a structure which has gradually evolved from the primitive policy of the ancient Romans, "caveat emptor" (let the buyer beware) through the struggle to assure one price to all, and finally to the pinnacle of the national reputation and the established selling price which result from judicious publicity.

The courts should not be held responsible for this state of affairs, as they are only interpreters of the law as it exists. A new law is needed to legalize price

maintenance. Such was the purpose of the Stevens Bill which was introduced at the last session of congress and now is "in committee." Strong opposition was developed against its enactment by big interests and it may be that the present session of congress will also adjourn without passing this needed measure.

Some hope has been expressed that the new Industrial Trade Commission, which assumes its duties with the opening of the new year, will give more immediate relief. Where price cutting can be shown to be unfair competition and in restraint of trade, this commission will be empowered to put a stop to the practice. Be this as it may, there is still need for a definite prohibition of this pernicious practice.

A great war is being waged for municipal ownership of public utilities, with the Pacific Coast as the battle-field. The columns of this journal have frequently been devoted to this question, space being given to both sides in the

The War for Municipal Ownership

controversy. Every endeavor has been made to present data from every standpoint so that the readers may be in a position to decide for themselves as to the merits of the case.

A technical magazine, such as the Journal, should maintain a position of strict neutrality, being a mirror rather than a mold of public opinion. Several times during the past four or five years the opinion has been editorially expressed that the theory of municipal ownership is excellent, but that the practice of political operation is poor. But the main question in itself, is still far from being decided.

Elsewhere in this issue, for example, Mr. E. F. Scattergood and Mr. H. J. Stocker defend the Los Angeles aqueduct against the attacks which have been made on it. Mr. Chas. E. Warner, on the other hand, repeats certain accusations which have not yet been explained or denied. Another article presents facts and figures about the situation in Seattle.

Further comment from our readers is invited on these subjects. No interpreter has been able to determine whether "municipal ownership," the handwriting on the wall, is warning or prophecy. Eventually the matter will resolve itself into a determination of the greatest good for the greatest number.

Today the result of all this agitation has been to retard private initiative and capital in the public service. The situation has become so serious in Oregon, whose many natural resources are largely undeveloped, that a conference was held at Eugene last week to provide a plan of hydroelectric districts similar to the irrigation district. This latter plan, while it may be of assistance in developing a territory, should be carefully safe-guarded so as to be sure that it is not being used to the detriment of those private parties who are already doing all in their power to develop those resources.

The equation of municipal ownership is one containing several unknown quantities. The approximate solution which can be found by observation does not satisfy many people, and it is only by the slow and costly method of actual trial that the answer will ultimately be found.

PERSONALS

Albert Sechrist, electrical contractor of Denver, Colo., has been spending the past week in Seattle.

J. Baugh, an electrical contractor of Petaluma, Cal., was a visitor in San Francisco during the week.

A. Turkill of the Reedley Electrical Works, Reedley, Cal., spent several days during the week in San Francisco.

Thomas Finigan, vice-president of Pierson-Roeding Company, has returned to San Francisco from an extended Eastern trip.

W. F. Detert has been elected president of the Northern California Power Company, and **H. H. Noble**, chairman of the board of directors.

Guy H. Talbot, president of the Portland Gas and Coke Company and Pacific Power and Light Company, spent a few days in Seattle recently.

H. V. Carter, president of the Pacific States Electric Company, has returned to San Francisco from the electrical jobbers' convention at Birmingham, Alabama.

C. B. Hall, manager of the Illinois Electric Company of Los Angeles, attended the Wass Hael at San Francisco on December 19th, after leaving the jobbers' convention at Del Monte.

J. G. De Remer, formerly chief engineer with the United Light and Power Company at San Francisco, is now associated with the American District Steam Company at North Tonawanda, N. Y.

Alex Taylor, manager of works, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., who is making a business trip on the Pacific Coast, arrived at San Francisco during the past week.

W. R. Lyall, Pacific Coast representative D. & W. Fuse Company, San Francisco, returned during the week after an extended business trip which embraced all the leading commercial centers of the Pacific Coast.

A. H. Babcock, electrical engineer for the Southern Pacific Company, and **A. G. Jones** of the General Electric Company, have returned to San Francisco from Tucson, Arizona, where the Arizona Railroad Commission approved the electric headlight being used by the Southern Pacific Company.

W. R. Putnam, new business manager of the Utah Power & Light Company, with headquarters at Salt Lake City, is making a trip through the Northwest, visiting Portland, Seattle, Spokane, and other points for the purpose of studying new business and operating practices of companies in that territory.

Chas. E. Warner, author of the paper on the Los Angeles Aqueduct Mistakes recently published in this Journal, is a consulting engineer with offices in the Electric Building, Portland, Ore. He was formerly chairman of the Los Angeles Aqueduct Investigation Board and member of the Los Angeles Board of Public Utilities.

A. C. Kingman, of the advertising department, Western Electric Company, New York, was a recent arrival at San Francisco. His stay in the Exposition City is expected to be somewhat extended, as Mr. Kingman will superintend the installation of his company's exhibit at the Panama-Pacific Exposition while on the Coast.

J. W. Goodwin has resigned as president of the Oro Electric Corporation. **Luther J. Holton** has been elected to the office of president. **R. L. Van der Naillen** was elected to the office of vice-president and general manager and acting under Holton will be responsible in all matters relating to the management and operation of the several departments of the various companies.

C. H. Christensen has been appointed manager of the Missoula (Mont.) Street Railway, the Missoula Light &

Water Company and the Clark Missoula Power Company, to succeed Mr. George R. Brown, deceased. Mr. Christensen has been connected with the Missoula Light & Power Company in various capacities for twenty years. During the last four years he held the position of superintendent of the Missoula Light & Water Company's Bitter-Root Valley system.

Arthur Gunn, president of the Wenatchee Valley Gas & Electric Company, Wenatchee, Wash.; **G. H. Hoppin**, assistant to superintendent of distribution, Washington Water Power Company, Spokane; **Charles North**, superintendent Revelstroke electrical department, Revelstroke, B. C., and **Leonard Tarrow**, erector with C. C. Moore & Company, San Francisco, have been elected associate members of the American Institute of Electrical Engineers.

C. R. Weymouth, chief engineer Chas. C. Moore & Company; **Frank H. Varney**, steam-electric engineer of operation for the Pacific Gas & Electric Company; **C. T. Hutchinson**, editor of Western Engineering; **J. T. Whittlesey**, engineer Claus Spreckels Building, and **H. L. Terwilliger**, first vice-president Harron, Rickard & McCone, have been elected members of the executive committee of the San Francisco Section of the American Society of Mechanical Engineers.

John Montgomery, contract agent of the Western Canada Power Company at Vancouver, B. C., is visiting in Salt Lake City. Mr. Montgomery for several years prior to 1908 was commercial agent of the Utah Light & Railway Company. He resigned to accompany Mr. R. F. Hayward to the City of Mexico where Mr. Hayward was in charge of the construction of large hydraulic electric plants to supply additional electric power to the national capital. Mr. Montgomery later accompanied Mr. Hayward to Vancouver where he was engaged in the erection of extensive hydraulic plants and transmission lines for the Western Canada Power Company. The depression in business occasioned by the war in Europe and its effect on the British colonies has made it necessary for the power company to curtail its expenses and the services of many of its employees including those of Mr. Montgomery has been temporarily discontinued.

MEETING NOTICES.

Oregon Society of Engineers.

The regular Monday luncheon was held at the Hotel Benson on December 14th. The speaker of the day was Judge John H. Stevenson of the municipal court, who spoke upon "Municipal Problems as Seen from a Municipal Court." Walter F. Graves presided as chairman. Mr. Stevenson said in part: That there was a vast amount of machinery in the United States to get a criminal into prison, but nothing to help him to a better life after he served his sentence. He felt a great sympathy for the people who committed crime through environment and who would never have become criminals except for environment. Also some were driven to crime by poverty and want. The insane, the criminal who inherits these instincts, those of arrested development mentally should all be put away for life, but those who on the spur of the moment commit crime and boys, should have scientific treatment, which is not done nowadays. Prisons should be the last resort. He cautioned fathers to properly rear their children and said he expected crime to decrease in Portland 50 per cent when the saloons were closed. Boys' crimes, according to his observation, developed in most cases in "pool rooms." He says that he does not think boys should be allowed in them under 21 years of age. This will be the last luncheon until after the holidays.

The Jovian Electrical League of Southern California.

A well-attended luncheon of the league, held at Christopher's, Los Angeles, on Wednesday, December 16, was presided over by C. T. Carr, as chairman of the day. Following the introduction of a number of guests, Tribune Pieper read a letter from H. H. Howell, representing the San Diego Jovians, containing an invitation to the Los Angeles Jovians

to come "down south" to attend the opening of the exposition and enjoy true Southern Jovian hospitality. The three-minute talks, which were highly amusing and interesting, were given by A. B. Day, on R. W. Murphy; H. N. Sessions on C. A. Renard, and J. M. Morris, on A. B. Day. A friend of the chairman, R. R. High, then entertained the audience with a very comical, original monologue, and he was followed by a talk on "State Insurance," by W. L. McConnell, local manager of the State Compensation Insurance Fund. The speaker gave a brief resume of the common law covering accidents, insurance practices, the rights of employer and employee, and the meaning of "assumed risk" and "contributory negligence." He pointed out the shortcomings of the common law as applied to the settlement of accident cases, and referred in glowing terms to the rather recently established, but highly successful, state compensation insurance fund, which was started with a \$100,000 state appropriation. About \$600,000 in premiums has already been collected, and the expense of operating the fund is about 9.31 per cent of the premiums. It is proposed to return 15 per cent of all premiums earned on January 1st, and with a 25 per cent reduction in the premium rate, there is a difference in favor of the policy holders of about 40 per cent. This 15 per cent refund simply represents a saving through the state's lower expense cost, and is being made without affecting the appropriation of the legislature. In other words, the state has conducted its business at an expense of about one-fourth that of stock companies, and the saving rightfully belongs to the policy holders. In addition to the low operating cost, the state fund has, during the first nine months, handled about 3000 accident cases, only 11 of which were referred to the Industrial Commission for hearing—a record of very nearly 100 per cent satisfaction to employers and workers.

California-Oregon Electric Club.

The Electric Club of the California-Oregon Power Company, held its monthly meeting in the club rooms, Electric building, Medford, Oregon, December 18th, 1914:

The subject for discussion was Contracts, and the Menus were in the following form:

Menu.

THIS AGREEMENT, made and entered into this 18th day of December, 1914, at the Club Rooms in the City of Medford by the and between the Electric Club, hereinafter designated as the Host, and the Officers and Employees of the California-Oregon Power Company, hereinafter designated as the Guest,

WITNESSETH: That the Host being the party of the first part, for and in consideration of the covenants and agreements herein contained on the part of the Guest, being the party of the second part, does covenant, promise and agree with the said Guest in the manner following, That is to say:

First: That the Host shall and will perform, furnish and deliver under the direction of the Chairman (Pro Tem) of the Electric Club, the following articles:

Menu.

Apple Cider.

Fruit Salad Chow-Chow Celery
Baked Chicken Pie—Gravy
Mashed Potatoes Corn
Whipped Cream Pudding Cake
Coffee.

Second: That the Guest shall test and prove the above articles through his natural organs of mastication.

Third: That should the Guest find the said articles to be of proper resistance, frequency and power factor and fused properly for any overload of amps—the Guest not to indulge too freely of same, so as to cause low speed, hearing troubles or lose his way Ohm-ward.

Fourth: The party of the second part agrees to pay to the party of the first part, the sum of Fifty Cents (50c) for services rendered.

Fifth: In any event, it is mutually agreed between the parties hereto that the spirit of this contract is to have a good and enjoyable time, and in default thereof, the sum of 23 dollars shall be paid for each offense as and for current damages as provided by Ohm's Law.

In Witness Whereof, the parties hereto have set their hands and seals, the day and year first above written.

CALIFORNIA-OREGON POWER CO. ELECTRIC CLUB.
EMPLOYEES OF CALIFORNIA-OREGON POWER CO.,

O. O. Alenderfer, Chairman Pro Tem.

Program—Subject, Contracts.

1. Nature and Essentials of a Valid Contract....A. C. Hough
2. Remedies for a Breach of Contract.....H. C. Stoddard
3. Forms of Contract.....F. F. Loder
4. How to Get a Contract Signed.....C. A. Malone
5. Why the Company Should Have a Contract With the
City of Gold Hill for Street Lights.....C. W. Martin
6. How a Contract Properly Filled Out Aids the Commercial Department in Keeping Its Records and Aid CollectionsR. R. Ebel
7. What Can the Employees Do to Increase the Efficiency of the Present Contract Now in Use by the CompanyAll Employees
8. Musical Imitations and "Near Songs".....J. L. Weiss

Those present were:

Jas. H. Moore, Glendale, Oregon; A. C. Hough, Grants Pass, Oregon; C. L. Clevenger, Grants Pass, Oregon; C. A. Malone, Ashland, Oregon; C. R. Dean, Ashland, Oregon; W. R. Johnson, Jacksonville, Oregon; and the following from Medford, Oregon: O. O. Alenderfer, J. J. Buchter, A. B. Cunningham, D. L. Coivig, G. B. Conwell, E. Curry, G. Darneille, R. R. Ebel, E. G. Henselman, F. F. Loder, Jas. Leslie, C. W. Martin, R. G. Medley, Dr. Porter, E. E. Scott, Gus Stinson, F. O. Stinson, W. H. Searle, H. C. Stoddard, J. J. Skinner, J. L. Weiss.

PACIFIC COAST ELECTRICAL JOBBERS' CONVENTION.

The regular quarterly meeting of the Pacific Coast Electrical Supply Jobbers' Association was held at Del Monte, Cal., December 16, 17, 18. While the inclement weather and the holiday season lessened the attendance, particularly of the ladies, the meeting was most profitable and enjoyable to all who attended.

Golf, as usual, was the chief attraction. It takes more than a Scotch mist to dampen the enthusiasm of the ardent golfer. The scores, however, were not up to the standard. So out of deference to the feelings of the contestants the records are omitted. In the manufacturers' contest B. A. Hansen won the jobbers' cup and the Del Monte trophy with a gross score of 96, though Sanderson's authenticated score of 73 caused much comment. Among the jobbers, C. C. Hillis, with a gross score of 89, won the copper cup and the Del Monte trophy. F. H. Leggatt won the Pass & Seymour cup and W. L. Goodwin the contractors' cup. The pool tournament was won by H. E. Sanderson, while in the absence of the ladies, S. H. Taylor was consoled with the putting prize.

At the open meeting on Friday afternoon Secretary Albert H. Elliott presented an able analysis of the new Industrial Trade Commission Act and the Clayton Bill.

The regular golf dinner on Friday evening was the occasion of much good natural raillery and flow of wit. A. H. Elliott, as toastmaster called on the various cup winners, each of whom gave brief response. The meeting then adjourned in order that the jobbers and their guests might attend the Wass Hael celebration at San Francisco.

Following is a list of those in attendance:

R. F. Behan, Westinghouse Elec. & Mfg. Co., San Francisco.
W. S. Berry, Western Electric Co., San Francisco.
T. E. Bibbins, General Electric Co., San Francisco.
T. E. Burger, Western Electric Co., Los Angeles.
C. H. Carter, Pacific States Electric Co., Los Angeles.
H. V. Carter, Pacific States Electric Co., San Francisco.
J. I. Colwell, Western Electric Co., Seattle.
A. H. Elliott, Secretary of Association, San Francisco.
W. L. Goodwin, Pacific States Electric Co., San Francisco.
N. W. Graham, Holabird-Reynolds Co., Los Angeles.
S. B. Gregory, Arrow Electric Co., San Francisco.
C. B. Hall, Illinois Electric Co., Los Angeles.

Brewster Hall, Pass & Seymour, San Francisco.
 A. H. Halloran, Journal of Electricity, Power and Gas.
 B. A. Hansen, A. G. Electric Co., San Francisco.
 Ross Hartley, Pacific States Electric Co., Portland.
 C. C. Hillis, Electric Appliance Co., San Francisco.
 P. B. Hyde, Thos. A. Edison, Inc., San Francisco.
 O. W. Lillard, Gould Storage Battery Co., San Francisco.
 F. W. Murray, National Carbon Co., Los Angeles.
 F. H. Leggett, Western Electric Co., San Francisco.
 A. H. Nylen, Gilson Electric Co., Oakland.
 R. F. Oakes, American Everready Co., San Francisco.
 F. H. Poss, Benjamin Electric Co., San Francisco.
 H. E. Sanderson, Bryant Electric Co., San Francisco.
 H. B. Squires, H. B. Squires Co., San Francisco.
 C. E. Wiggins, Dunham, Carrigan & Hayden Co., San Francisco.
 A. G. Young, Telephone & Elec. Equipment Co., San Francisco.

1914 WASS-HAEL.

The annual "Wass-Hael" festival of the San Francisco electrical men was held on Saturday afternoon, December 19th, at a local cafe. Four hours of feasting, fun and frolic were enjoyed by the 237 men who were fortunate in attending this celebration, which has now become an annual institution dear to the hearts of all.

Mr. Thomas E. Collins presided at the merry-making and introduced the several purveyors of amusement, as shown in the following:

James LemonPiper
 Oscar DericoLeader of Musicians

CAMILLE MAILHEBEAU
 Chief of Cuisine

TOASTMASTER'S ADDRESS OF WELCOME

A. V. ThompsonMessenger Boy No. 23
 Dr. Leo J. McMahon.....The Original Bacigalupi
 Joe Thompson.....Making Harry Lauder Jealous

JACK HOLLAND
 Injineer of the Fish Boat Rosemarie

FRANK FOWDEN
 Some Voice

DICK HUNT
 John's Little Brother, in a Solo

THE QUARTETTE
 H. H. Daley, Carroll Morris, Fred Poss, Dick Hunt
 Some Harmony
 IMPROMPTU

Among those who were present were:

R. M. Alvord
 Howard Aylsworth
 R. A. Balzari
 Dr. F. A. Balkin
 J. M. Barry
 Geo. H. Battee
 E. W. Beardsley
 C. C. Beatie
 R. F. Behan
 Wm. Bendel
 W. S. Berry
 Henry Bostwick
 Chris. Bradley
 H. H. Brand
 A. H. Braunagel
 J. E. Bridges
 W. W. Briggs
 A. T. Brown
 E. C. Brown
 J. Q. Brown
 John R. Brownell
 E. E. Burgess
 Munson Burton
 Felix Butte
 Paul Butte
 T. E. Collins
 N. K. Cooper
 H. W. Cope
 H. Cordell
 W. H. Cortelyan
 Harry Corvin
 F. J. Cram
 J. E. Crilly
 J. A. Crombaeh
 B. C. Crowley
 H. W. Crozier
 Geo. Curtis
 E. M. Cutting
 H. H. Daley
 K. I. Dazey
 Thos. Degen
 Eddy Dewald

S. B. Gregory
 E. E. Gribble
 C. B. Hall
 W. B. Hall
 W. F. Hall
 Max Hallauer
 A. H. Halloran
 Milton Hamilton
 Ed. Hammer
 Harry Haud
 W. S. Handbridge
 W. W. Hanscom
 A. B. Hansen
 Percy Hardenberg
 C. E. Hardy
 A. M. Harvey
 H. L. Harkness
 Maury Harriman
 Dave Harris
 F. W. Harrison
 P. N. Harrison
 T. A. Hays
 C. E. Heise
 Al. Herbert
 C. D. Herbert
 J. P. Hermans
 Ben Herr
 Frank Herrguth
 Mel Herzog
 C. C. Hillis
 R. D. Holabird
 Jack Holland
 Nelson M. Hope
 John Hunt
 R. H. Hunt
 Fred E. Hummel
 P. B. Hyde
 H. F. Jackson
 Sam Johnson
 Fred H. Jones
 G. Douglas Jones
 Max Jones

Harry Dodge
 A. Drendell
 W. R. Dunbar
 Bill Dunphy
 A. B. Edes
 C. W. Edgecomb
 Bob Eltringham
 Chas. M. Eufficy
 W. G. B. Euler
 H. F. Fisher
 Carl Foard
 C. H. Forsland
 W. Frieman
 A. R. Fuller
 H. W. Gallett
 S. G. Gearhart
 S. W. Gilman
 W. S. Gragg
 N. W. Graham
 F. S. Gray
 W. S. Greenfield
 M. H. Gregg

Walter Jones
 Sam Kearney
 C. M. Kellogg
 F. N. Killam
 Arthur Kingston
 James Knapp
 I. W. Knibbs Jr.
 W. P. L'Hommedieu
 W. E. Lee
 F. H. Leggett
 Henry Levy
 Walter Levy
 Sam'l Magner
 C. I. Martin
 H. M. Mason
 A. J. Matson
 L. A. Matt
 Adolph Meese
 N. B. Miller
 Thos. Mirk
 Dr. H. W. Moore
 Alan E. Morphy
 T. C. Morris

Geo. N. Stroh
 Chas. Sutton
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 D. A. Thompson
 Harry Thompson
 Jos. Thompson
 Fred Tregoning
 J. A. Vandegrift
 Samuel Walton
 Ed. Whaley
 Jos. White
 J. W. White
 I. F. Whitehurst
 L. H. Whitham
 Geo. Williams
 F. W. Wilson
 A. Emory Wishon
 Henry Yost
 Al. Youngholm

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
 Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
 John W. Carrell, Secretary-Treasurer, 814 Scott, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correlate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

The prime purpose of the Code Committee, National Fire Protection Association, is to draft specifications for safe electrical construction and the practical accomplishment of this task is aided by experts representing interests affected by results attained. The regular bi-annual meeting of this committee will be held in March, 1915. Current news items in electrical magazines and pamphlets issued from private sources indicate that representation will be made at this time proposing a cheaper method of wiring buildings. These representations will probably be accompanied with specifications worked out by proficient specialty engineers.

All persons will concede that if the cost of installation is reduced, the demand for use of electricity will increase and that, if the proper degree of safety is maintained, the community will be benefited; but just how this wonder working is to be effected will be interesting to learn.

In the last ten years development in manufacture of electrical trade material in the United States has been rapid and the efficiency of the workman has increased with this development so that for high class installations of concealed wiring the cost is less than maintains throughout Europe for installations of exposed work, standards, cost of living, etc., considered.

In view of the present day tendency to speak lightly of the hazards due to poor electrical installations, the following may be of interest. If we assume that in the construction and equipment of a building there are ten sources which may cause fire, including hazards due to faulty wiring; that there are 100 buildings in four adjacent city blocks, and

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 that there is a ——— chance of fire from each of the ten
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sources in each building, then the degree of probability of fire for the 100 buildings is represented by "nity, or certainty. The possibility of fire in any of the buildings is not affected by the degree of probability, and the actual event in one building does not affect the possible event in any other.



NEWS NOTES



FINANCIAL.

SAN FRANCISCO, CAL.—E. H. Rollins & Sons will purchase and extend \$400,000 Ferries and Cliff House 6 per cent bonds, an underlying security of the United Railroads. The remaining \$200,000 will be paid at maturity. The present arrangement provides for extending \$400,000 to December 31, 1916, or two years from the expiration of the first extension. It is understood that the company has provided for the cancellation of \$200,000 of the bonds out of current earnings.

INCORPORATIONS.

SACRAMENTO, CAL.—Aerial Electrical Company, \$100,000, by J. L. Harvey, J. L. Flanagan, Jim and Abbie Thompson.

LOS ANGELES, CAL.—The Telegraph Transmitter Company, \$125,000, subscribed in full, by F. D. Fowler, C. G. and Ada E. Taylor.

SAN FRANCISCO, CAL.—Surface Electric Railway Supply Company, \$25,000, shares \$1 each, subscribed \$3, by J. A. Wheeler, S. G. Mitchell and S. Theisen.

ILLUMINATION.

SAN BERNARDINO, CAL.—The Yuma Gas Company has decided to change its principal place of business from this city to Los Angeles, on December 28th.

CLATSOP, ORE.—The board of directors has granted to the Pacific Power & Light Company a 50 year franchise to operate and maintain a power service here.

HERMOSA BEACH, CAL.—The Enterprise Electric Company has been awarded a contract to install an electric line to light the concessions at the outer end of the pier.

GOLDHILL, ORE.—Bids will be received until January 11 for the installation of a street lighting system, and furnishing electric current therefor for a period of ten years.

SODA SPRINGS, IDAHO.—A special election has been called for December 28th to vote upon the issuance of \$15,000 worth of bonds for the installation of a municipal lighting plant.

CULDESAC, IDAHO.—W. L. Marrs, recently granted a light franchise here, is repairing the old E. P. Atchison plant for use until extensive improvements can be made and a new light system be installed.

GOLD HILL, ORE.—Bids will be received until January 4th by B. G. Harding, recorder, for the contract for street lighting system for the city. Plans and specifications to accompany bids. Certified check for \$600 to accompany bid.

MONTESANO, WASH.—Plans for a new electric power plant here to be ready for operation by spring have been prepared for the Northwest Electric & Water Works Company. Plans include steam power plant located on water front.

PITTSBURG, CAL.—The Contra Costa Gas Company promises that gas will be ready for delivery by March next. Following the introduction of gas service to Pittsburg the company will extend its system to Antioch, then to Concord and Martinez.

FORT BIDWELL, CAL.—It is said that a gas lighting plant is soon to be installed at Eagleville by H. H. Dunbar, R. R. Rice and J. McCosh Smith, and it is understood these same gentlemen intend to install a similar gas plant at Fort Bidwell in the near future.

VICTORVILLE, CAL.—The Southern Sierras Power Company has purchased the interest of G. H. Christ in the Victorville Electric Light & Power Company and will at once put in street lights, contract for which was approved by the county supervisors some time ago.

STOCKTON, CAL.—The city of Stockton, Cal., has accepted the bid of the Western States Gas and Electric Company for street and boulevard lighting for a term of five years from December 15th. The contract will cover the present system and certain additional lighting.

PHOENIX, ARIZ.—At a recent meeting of the city commission, a contract with the Pacific Gas & Electric Company whereby the city secures current for all lighting and power purposes at 2½ cents per kilowatt hour, was accepted by the commission over the protest and negative vote of the mayor.

BAKER, ORE.—An election will be held at an early date for the purpose of voting on bonds in the sum of \$180,000, the proceeds of which are to be used in the construction of a municipal lighting plant. L. R. Stockman has been employed to prepare plans for the plant and J. L. Stannard is consulting engineer.

PORTLAND, ORE.—Electrical workers and small electrical contractors of this city won the recent fight against incorporating in a proposed new electrical code, a provision requiring that a cash bond in the sum of \$100, in addition to a surety bond of \$500, be deposited with the city to guarantee the proper installation of electrical fixtures.

ABERDEEN, WASH.—With the passage of the ordinance in the election at Hoquiam granting a franchise to L. H. Burnett and associates, Mr. Burnett's company has secured the entire field in the Grays Harbor country to carry on their proposed line of gas enterprises in Chehalis county. After the first of the year the company will start building in Montesano and Elma.

BOISE, IDAHO.—The assessment roll covering the special street lighting recently put in operation in this city will be ready for the approval of the city council at its next meeting. All points of adjustment have been worked to a satisfactory conclusion and the city engineer's office is at work figuring the individual apportionment of all of the property owners in the district. After the assessment roll has been approved the council will set a day of protest at which time all property owners who for any reason are not satisfied with their apportionment of the expenses may enter a protest for a readjustment of their assessment.

TRANSMISSION.

WALLACE, IDAHO.—The Montana Power Company is making rapid progress in extending its transmission lines into the Coeur d'Alene district.

SACRAMENTO, CAL.—The Great Western Power Company has secured the contract for furnishing power to the new city pump. The contract, which will run for five years, amounts to about \$20,000 per year.

GREEN RIVER, UTAH.—The Green River Irrigation District, of which S. J. Meer is city clerk, will receive bids up to January 4, 1915, on bare and insulated copper, insulators, pins, cross arms, and other line material for seven miles of transmission of distribution lines for the electric light system to be installed here. Also for the manufacture, delivery, and erection of hydraulic and electrical apparatus

to be installed in the power house of the Green River Irrigation District and on 275-30 to 35 foot cedar poles. Plans and specifications for this material may be obtained from the city clerk.

TOOELE, UTAH.—The Clark Electric Power Company of this city has entered into a contract with the Utah Power & Light Company to purchase their requirements of electric power on a wholesale contract from the latter company. The local electric company has been taking about 200 horsepower under this contract since December 1st, and are now in a position to give first class service to their customers. Superintendent Anderson of the Clark Electric Company has instituted a number of innovations to encourage the installation of meters and the use of continuous current, which will not only result in benefit to the company's patrons but also in an economy of power for the company.

TRANSPORTATION.

CALDWELL, IDAHO.—Citizens have agreed to take bonds of the Caldwell Traction Company to finance the construction of the Wilder branch of the Oregon Short Line. The estimated cost of electrifying is \$50,000.

SEATTLE, WASH.—Scott Calhoun, one of the receivers of the Seattle, Renton and Southern Railway Company, alleges in a suit brought to set aside a contract for current, that the Puget Sound Traction, Light and Power Company was organized in violation of the anti-trust laws of the State of Washington and the United States.

SAN FRANCISCO, CAL.—The supervisors rejected the proposition to build a cable line on Church street by a vote of 9 to 8. They instructed the board of public works to prepare plans for the construction of an extension to the Municipal Railway in Church street using appropriations already voted by the board. The vote on this was 14 to 3.

SAN FRANCISCO CAL.—The contract for constructing the California street Municipal Railway line has been awarded to F. Rolandi, the lowest bidder, for \$101,308. In addition, a maximum bonus of \$7500 for quick completion is provided for, and about \$4000 will be required in connection with paving. Rolandi will begin at once at Second avenue and Geary street. He is to have the track constructed to California street and Sixth avenue by January 3d, which will be the last day on which the United Railroads' cars will run on California street between Sixth and Thirty-third avenues.

SEATTLE, WASH.—A report as to the estimated cost of operation, cost of maintenance, improvements needed, and expected earnings of the Seattle, Renton and Southern Railway has been prepared and submitted to Mayor Gill of this city for the enlightenment of the city council. The report was compiled by A. L. Valentine, superintendent of public utilities; A. H. Dimock, city engineer, and J. D. Ross, superintendent of the lighting department. The report places the receipts of \$320,000 under municipal control with minimum wage and eight-hour day and the outlay at \$236,010, including interest and improvements.

SALT LAKE CITY, UTAH.—Installation of an added unit to the company's storage battery system has been completed by the Utah Light & Traction Company, increasing the capacity of the system between 25 and 30 per cent. The original storage battery system was installed six years ago in the company's power station and transmission plant in the square bounded by First South and Second South streets and Main and West Temple streets. The plant was installed as an emergency equipment, to carry the normal elevator load and other direct current load handled by the company for thirty minutes, in the event of trouble with the generating and transmission plants supplying service in the business district.

TELEPHONE AND TELEGRAPH.

FALLON, NEV.—The Bell Telephone Company has been granted a franchise along the old Southern Pacific roadbed in the northern part of the county, where a line was recently constructed.

VALLEJO, CAL.—In view of the fact that inshore wireless stations are now being advocated by radio experts, Sawyer Island, just north of Mare Island, has been selected as the location for a high power plant for the government.

SILVER CITY, N. M.—As the result of investigations and recommendations of Geo. Kimball, special agent for the Mountain States Telephone & Telegraph Company, Mogollon is to have its own telephone exchange, connecting with Cooney, Alma and outlying districts of Socorro county by a toll and subscription line and linked to the city by toll line. A new 100 line switchboard will be installed.

CALIPATRIA, CAL.—The first telephone exchange in the north end of Imperial Valley is being installed by the Bell Telephone Company in Calipatria. Service previously given here through a pay station was inadequate to the business of this city and its immense surrounding farming district, and officers of the telephone company from Los Angeles and other points have been here for several days arranging the establishment of a central station and the putting up of lines all through the business, residential and agricultural sections. The work will be pushed as quickly as possible and complete local and long distance service will be available within a brief time.

LOS ANGELES, CAL.—The Safety Commission, acting as an advisory board to the bureau of Fire alarm and police telegraph, has filed an exhaustive report with the city council, recommending the installation of a complete new fire alarm and public telegraph system, covering the entire city. The commission consists of Councilman Snowden, Fire Chief Eley, Chief of Police Sebastian, and City Electrician Manahan. It is recommended that the central station be located in the fire-proof engine house near the corner of Seventh and Figueroa streets, but that at the earliest possible time a special building be erected for it in one of the city parks, so as to be immune from destruction in a general conflagration.

WATERWORKS.

LOS ANGELES, CAL.—At a meeting of the Board of Supervisors a franchise for water pipe lines in Tract No. 2704 was awarded to John Carner.

SEATTLE, WASH.—Water pipe franchises have been granted to Patrick Downey and A. B. Strong of Bellevue, Wash., for a term of 10 years.

VALLEJO, CAL.—Officer G. A. McKay, has received authority from the Navy Department for the installation of an extension to the salt water fire system at Mare Island, at a cost of about \$10,000.

REEDLEY, CAL.—All bids recently submitted to the city for the construction of a building and the installation of an auxiliary pumping plant for the city water works were formally rejected. Trustees will take further action in the matter at an early date.

GOLDFIELD, NEV.—Bessie Miller, of Dyer, Nev., has applied to the State Engineer for permission to appropriate waters from Fisk Lake and its tributaries by means of pumping plants, canals, aqueducts, ditches and pipe lines for irrigation and domestic purposes.

NORTH YAKIMA, WASH.—Notice has been received of the award of construction contracts on the Bonton Extension. Excavation to Rowan & Anderson; steel flume, Oregon Bridge Company, and woodstave pipe to the Washington Pipe Company. Concrete work is estimated at \$13,000, which will bring the cost to about \$69,000.

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